REPORT

UPDATE GEOLOGIC HAZARDS STUDY
SHADOW RUN RANCH
PAUMA VALLEY, CALIFORNIA

Prepared for

Shadow Run Ranch, LLC
P.O. Box 1249
Pauma Valley, CA 92061

URS Project No. 27665024.00002

September 29, 2009

URS

1615 Murray Canyon Road, Suite 1000
San Diego, CA 92108-4314
619.294.9400   Fax: 619.293.7920

URS

September 29, 2009

Sherrill Schoepe, Manager
Shadow Run Ranch, LLC
P.O. Box 1249
Pauma Valley, California, 92061

Subject: Update Geologic Hazards Study
Shadow Run Ranch
Pauma Valley, California
URS Project No. 27665024.00003

Dear Ms. Schoepe:

This report presents the results of the URS Corporation's (URS) update geologic hazards study for the proposed Shadow Run Ranch residential development in Pauma Valley, northern San Diego County, California. This technical study updates our previous geologic hazards study report dated July 13, 2005, and is intended to support the Environmental Impact Report being prepared by TRS Consultants. This update study responds to review comments from the County of San Diego pertaining to Geologic Hazards (County of San Diego 2006).

Please let us know if you have questions or if we can be of further service.

Sincerely,

URS CORPORATION

David L. Schug, C.E.G. 1212
Principal Geologist

DLS:ml

URS Corporation
1615 Murray Canyon Road, Suite 1000
San Diego, CA 92108
Tel: 619.294.9400
Fax: 619.293.7920

TABLE OF CONTENTS

Section 1 Introduction 1-1

1.1 Purpose and Scope 1-1

Section 2 Project and Site Description 2-1

Section 3 Regional Geologic Setting 3-1

3.1 Physiographic Setting 3-1
3.2 Geologic Structure 3-1
3.3 Stratigraphy 3-2
3.4 Tectonic Setting 3-2
3.5 Historical Seismicity 3-3

Section 4 Local Geologic Setting 4-1

4.1 Site Geology 4-1
4.2 Site Faulting 4-1

Section 5 Geologic Hazards 5-1

5.1 Fault Rupture 5-1
5.2 Ground Shaking 5-1
5.3 Seismically Induced Ground Settlement 5-1
5.4 Liquefaction and Lateral Spreading 5-2
5.5 Landslides and Slope Instability 5-2
5.6 Collapsible and Expansive Soils 5-3
5.7 Other Hazards 5-3

Section 6 Impacts and Mitigations 6-1

6.1 Fault Rupture 6-1
6.2 Ground Shaking 6-1
6.3 Seismically Induced Ground Settlement 6-2
6.4 Liquefaction and Lateral Spreading 6-2
6.5 Landslides and Slope Instability 6-2
6.6 Collapsible and Expansive Soils 6-2
6.7 Other Hazards 6-2

Section 7 References 7-1

Tables

Table 1 Summary of Soil Age Estimates

Figures

Figure 1 Vicinity Map
Figure 2 Site Layout
Figure 3 State of California Special Studies Zone
Figure 4 Regional Fault and Epicenter Map
Figure 5 Geologic Map
Figure 6 Quaternary Geologic Map
Figure 7 Geologic Cross Sections A-A' through C-C'
Figure 8 Site Fault Map
Figure 9 Topographic Maps- Existing Reservoir
Figure 10 Generalized Cross Sections- Existing Reservoir

Figures

Appendix A Logs of Additional Exploratory Trenches

SECTION 1 INTRODUCTION

This geologic hazards study was prepared to assist TRS Consultants with the preparation of an Environmental Impact Report (EIR) for a proposed residential development in the Pauma Valley area of North San Diego County, California. The geologic conditions have been described based on previous subsurface investigations performed for the project, and review of published information on the geology of the area. The subsurface investigations were performed by URS and presented in the "Fault Hazard Investigation, Schoepe Tentative Map, Pauma Valley, San Diego County, California," dated December 4, 2001.

The location of the project area is shown on Figure 1. Figure 2 shows the configuration of the proposed development. Locations of proposed residential structures were not available at the time of this report.

1.1 PURPOSE AND SCOPE

The purpose of this updated geologic hazards study was to address review comments from the County of San Diego pertaining to Geologic Hazards (County of San Diego 2006). Responses to County of San Diego comments are provided in the appropriate sections of this report.

URS previously performed a fault hazard investigation of the Elsinore fault within the Alquist-Priolo Earthquake Fault Zone, as mapped on the property by the State of California, 1980 (see Figure 3). For that study, exploratory trenches were excavated to document the location of the Elsinore fault, and to provide fault set-back recommendations for the proposed residential development.

Based on our previous study, a branch fault was suspected to project near the existing on-site earthen water storage reservoir. A suspected fault had also been mapped between the existing reservoir and the nearby hillside. The County of San Diego recommended additional trenching to confirm that the existing reservoir does not overlie an active fault (County of San Diego 2006). As discussed in this updated report, additional fault trenches were excavated to confirm the absence of faulting in the vicinity of the reservoir. Logs of the additional exploratory trenches are presented in Appendix A. Results of the fault trenching are discussed in this report.

SECTION 2 PROJECT AND SITE DESCRIPTION

The project area covers approximately 248 acres located along State Route 76, about ten miles east of Interstate 15. The proposed residential development would encompass about 99 acres. The proposed development would include several new roads with open-space lots along Frey Creek and the hillside areas. Figure 2 shows the configuration of the proposed development.

The site has been in agricultural use for several decades and currently supports a variety of fruit groves, including avocado, grapefruit, orange, and lemon trees. The proposed residential development would convert some of the agricultural land into residential and open-space lots. The property occupies a broad, gently sloping, terrace-like surface that slopes down to the south toward the San Luis Rey River with steeper terrain to the north toward Agua Tibia Mountain.

The proposed development area is down slope of the mountain front. The natural drainage course of Frey Creek and several other shallow, unnamed drainages extend through the property into the San Luis Rey River. The groves are interconnected by paved and unpaved access roads. Mature oak trees are interspersed within the fruit groves within Frey Creek and other areas of the site.

Windrows of large boulders are scattered throughout the property. Some of the boulders are "in place," but most were removed and then stockpiled during previous site clearing and grading. It is apparent that development of the fruit groves involved some minor land leveling and grading. However, general elevation differences appear small, and the geomorphic expression of natural landforms appears to be relatively unchanged within most of the site.

A existing, earthen water supply reservoir occupies a mesa at the foot of the hillside in the area above the proposed development (see Figure 2). The reservoir encompasses about 3 acres and is surrounded by orchards and oak groves. The reservoir stores water pumped from on-site wells and catch-basins in Frey Creek. The reservoir was constructed in the early 1960's by making a shallow, bowl-shaped cut into the mesa top and creating a low earth-fill embankment around the margins of the reservoir. A layer of bentonite was placed along the bottom of the reservoir to improve water retention.

The existing reservoir is used for site agriculture. The reservoir contains a maximum of approximately 41 acre-feet of water. An existing 6-inch PVC pipeline feeds distribution lines leading down to the orchards. An existing 12-inch outlet pipeline extends from the reservoir to near the margins of the San Luis Rey River. A 24-inch outlet pipe (at approximate elevation 1,085 feet, MSL provides a spillway that disperses any overflow to the adjacent avocado grove. The outlet maintains the maximum water level at below about 1,085 feet, MSL.

SECTION 3 REGIONAL GEOLOGIC SETTING

This section provides a description of the regional geology of the project area.

3.1 PHYSIOGRAPHIC SETTING

The site is in the Peninsular Ranges Physiographic province. This province is characterized by a series of northwest oriented mountains ranges and intervening valleys that extends from Baja California to the Transverse Ranges, north of the Los Angeles Basin. In the San Diego region, the province consists of an inland mountain range with a steep eastern slope and a gradual western slope bounded by coastal plains and terraces. The Salton Trough physiographic province lies to the east and the Continental Borderland to the west. The Transverse Ranges and Los Angeles Basin provinces lie to the north and northwest, respectively. Westerly trending river systems drain the province and include the San Luis Rey River in the project area.

The property encompasses portions of broad alluvial fans emanating from Morgan Hill within Agua Tibia Mountain. Agua Tibia Mountain extends up to about 3,700 feet above mean sea level (MSL). Pala Mountain (approximate elevation 2,100 feet MSL) is southwest of the property across the San Luis Rey River.

The site is located on an alluvial fan surface derived from erosion of the nearby steep granitic mountain slopes of Agua Tibia Mountain to the east. Frey Creek is a natural drainage course cut into the alluvial fan deposits. Frey Creek and lesser, unnamed drainages cross the site and drain the general site area into the San Luis Rey River.

3.2 GEOLOGIC STRUCTURE

The regional geologic structure of southern California is dominated by right-slip faulting associated with the boundary between the Pacific and the North America plates. The Pacific plate is moving northwest relative to the North America plate approximately 5 to 6 cm (2 to 2.5 inches) per year (Minster and Jordan, 1978). This slip is distributed by the principal, predominantly northwesterly trending, right-slip faults across California and the continental borderland as shown on Figure 4, regional fault and epicenter map.

The San Diego area lies within this regional fault system which includes the San Andreas, San Jacinto, to the east and the Rose Canyon, Coronado Bank, San Diego Trough and San Clemente fault zones to the west. The most significant regional fault for the project is the Elsinore fault zone which passes through the project site. This fault has been zoned as an active earthquake fault under the State of California Alquist-Priolo Earthquake Fault Zone Act. Figure 3 presents the Earthquake Fault Zone map of the Pala 7½-minute USGS quadrangle.

3.2.1 Elsinore Fault Zone

The Elsinore fault zone is one of several major strike-slip fault zones in southern California (Figure 4). Together with the broad San Andreas system of northwest-striking and right lateral faults, the Elsinore fault accommodates a portion of the plate tectonic movement between the North American and Pacific plates. The rate of plate movement as mentioned above is estimated at 5 to 6 centimeters per year, of which the Elsinore may contribute up to about 5 to 7 millimeters, or approximately 10 percent of the total plate tectonic movement.

The Elsinore fault zone comprises a series of right-slip faults extending from the Los Angeles Basin south to the U.S./Mexico Border. Through a long displacement history, the Elsinore fault has produced a series of alternating high and low physiographic features along its length. Some of the regional fault-related landforms near the project include Temecula Valley (low area), Agua Tibia Mountain and Palomar Mountain (high areas), Lake Henshaw (low area), and many other well-expressed features between Lake Elsinore and Julian.

Within Pauma Valley, the Elsinore fault zone extends along the northern margin of the valley, where the fault approximately coincides with the northwest-trending mountain front of the Agua Tibia range. North of Pala (and northwest of the property) the fault is mapped as two sub-parallel strands, referred to as the “High Valley Graben” (Vaughn and others 1999).

3.3 STRATIGRAPHY

The oldest rocks outcropping in the site vicinity are crystalline basement rocks. These rocks include the Cretaceous age batholithic rocks of Agua Tibia Mountain and the older pre-Cretaceous metamorphic and metasedimentary rocks in the north-northeast portion of the site. Rock units mapped in area include the Woodson Mountain Granodiorite and the San Marcos Gabbro. The pre-Cretaceous metamorphic rocks are not named, according to Kennedy, 2000. Figure 5 is a geologic map of the site and nearby areas.

Erosion of the high relief Agua Tibia Mountain has generated broad, coalescing alluvial fans along the margins of the San Luis Rey River Valley. The site is underlain by alluvial fan deposits that include cobble to large boulder clasts of predominantly granitic rock. The alluvial fan deposits range in age for Pleistocene to Holocene age. Alluvium is present in the San Luis Rey River Valley and in the lesser tributary drainages like Fry Creek. Figure 6 is a Quaternary geologic map of the site and adjacent areas.

3.4 TECTONIC SETTING

The tectonic setting of the San Diego region is complex and includes the remnants of an ancient subduction zone- volcanic arc system, regional uplift, and the subsequent formation of a broadly defined transform plate boundary along the North America and Pacific plates. The Peninsular Ranges are the remnant of an ancient tectonic system and represent the deep crustal roots of a volcanic arc that was active during Cretaceous time. At that time a subduction zone-volcanic arc system extended from northern California to Baja California in what was then a continuous tectonic and physiographic system. In this setting, subducted oceanic crust was thrust below the continental crust and subsequently melted, giving rise to deep magmatic bodies that feed a volcanic chain. The Andes in South America are a modern example of a volcanic arc as created by an offshore subduction zone.

About 20 million years ago, the subduction zone tectonics were replaced by transform movements along strike slip faults. These faults began to cut, slide and rotate the mountainous chain into a series of blocks.

Uplift and erosion have stripped away the volcanic elements of system leaving only the deep magma bodies. The remnant blocks of these deep magma bodies include the Sierra Nevada, Transverse Ranges, and the Peninsular Ranges. The transform boundary tectonics still dominates the region today in the form of the San Andreas Fault System.

3.5 HISTORICAL SEISMICITY

The Peninsular Ranges are an active tectonic province given the numerous active faults in the region. Figure 4 presents a regional fault and epicenter map showing historical seismicity. The San Jacinto fault to the east has been the most active component of the San Andreas system in the vicinity of the Peninsular Ranges. The Elsinore fault has had shown significantly less historical seismic activity.

Historically, the Elsinore fault has not produced a major earthquake near Agua Tibia Mountain. An earthquake in 1885 may be the nearest large event (estimated range of magnitude 5.8). The event is placed southeast of the project area in Pauma Valley (Toppozada and others 2000). The 1910 Temescal Valley earthquake (near Lake Elsinore) is assigned a magnitude 6.0. Smaller-magnitude events are generally located in or near Pauma Valley, but none of these small events has produced local damage.

SECTION 4 LOCAL GEOLOGIC SETTING

The following characterization of site geology and faulting is based on a review of available information and on the subsurface investigations performed as part of the previous fault hazard investigation (URS 2001).

4.1 SITE GEOLOGY

The proposed development area is underlain by a thick sequence of Quaternary alluvial fan deposits. Quaternary geologic units and alluvial surfaces previously mapped in the area (Vaughn 1987) are shown on Figure 6. The alluvium exposed within natural slopes, roadcuts, and trenches is composed of fine to coarse sand with gravels, cobbles, and boulders. The coarse clasts are composed of granite, gabbro, and some schist. The alluvium may have been derived from the ancestral San Luis Rey River, as well as from the subsidiary drainages that extend across the property (such as nearby Agua Tibia Creek and Frey Creek). The alluvial fan deposits in the project area are estimated to be between 300 and 700 feet thick, based on available driller's logs of on-site water wells.

The alluvial fan deposits in the project area are interpreted to span a fairly wide age range. A previous study of alluvial stratigraphy recognized seven alluvial units associated with stable, geomorphic surfaces ranging from historic gravels within present-day stream channels, to mid-Pleistocene alluvium that exhibits a clay-rich soil profile (Vaughn 1987). The chronology of alluvial units in the area is based on observations that recognizable features within a soil profile tend to increase with increasing age (e.g., soil redness, clay content, soil structure, and thickness). The age estimates for these map units are summarized in Table 1.

Figure 7 presents a series of geologic cross sections across the site showing the physical relationships between some of the alluvial units and the faults, and the topography. Locations of the cross-sections are shown on Figure 8.

4.2 SITE FAULTING

When traced southeast toward the site, the Elsinore fault zone makes an easterly bend where Pauma Valley narrows (Figure 5). This change in fault trend (strike) is interpreted to represent a major change in tectonic style and is located immediately south of the site area. The northwesterly orientation is consistent with predominantly right lateral slip (predominantly horizontal movement), whereas the bend may represent a regional "restraining bend." The fault bend produces local uplift (vertical movement) associated with "transpression." In this setting, strike-slip faulting might be accompanied by thrust faulting within the area of the fault bend. Pronounced fault-related physiographic features southeast of the property include a series of prominent ridges and benches that are indicative of local uplift. Therefore, the project area would appear to lie within a transition from predominantly right lateral (horizontal) fault movement, to oblique faulting (*i.e.,* a combination of horizontal and vertical movement). Future fault movement in this setting could result in combinations of horizontal and vertical displacements.

The previous fault hazard investigation (URS 2001) mapped a through-going “Main Fault” as shown on Figure 8. The Main Fault represents the main surface trace of the Elsinore fault which on-site coincides with a pronounced, west-facing fault scarp, as revealed in the exploratory trenches excavated as part of the previous investigation. Fault set-backs for the proposed residential structures were recommended from the Main Fault, as shown on Figure 8.

4.2.1 Branch Faulting

Two branch faults (deemed the “North Branch Fault” and “South Branch Fault”) were also mapped on site (URS 2001). Locations of the North and South Branch Faults were based on air photo interpretations, and fault-features indicated in Trenches 7 and 6, respectively. From the previous study, both branch faults were suspected to potentially continue further north than their respective trench locations. A continuation of the South Branch Fault, if present could extend near to, and possibly underlie the reservoir. Supplemental trenches (Trench 9 and Trench 11) were excavated to investigate whether or not the South Branch Fault extends below the reservoir. Locations of these trenches are shown on Figure 8. Logs of these trenches are included in Appendix A. Logs of trenches previously performed on site are included in our 2001 report.

No evidence of faulting was observed in Trench 9. The trench was about 140 feet long, and extended at depth into older alluvial fan deposits. Based on the completely weathered (decomposed) appearance of granitic cobbles and boulders, and the distinct reddish-brown color of the deposit (see Figures A-1 and A-2, Appendix A), the older alluvial deposits within the trench were judged to be pre-Holocene in age (i.e., older than about 10,000 years before present). The older alluvium within the trench appears to correlate with alluvial deposits at least Q5 or older, based on the previous geomorphic assessment of Pauma Valley (Vaugh 1987).

No evidence of faulting was observed in Trench 11(see Figure A-5). The location of Trench 11 was selected to further verify the absence of faults near the reservoir. The absence of faulting in Trenches 9 and 11 indicates the South Branch Fault appears to bend westerly and does not underlie the reservoir, as shown on Figure 8. Linear topographic features also suggest the slightly more westerly fault location.

A suspected fault was mapped previously between the reservoir and the base of the mountain front (URS 2001). The fault was interpreted to form the fairly abrupt break in slope at the toe of the hillside. The fault is not shown on the State of California Earthquake Fault zone map (DMG 1980), and is also not shown on an updated geologic map by Kennedy (2000), see Figure 5. Trenches 10A and 10B were excavated across the trend of the suspected fault; the locations of the trenches are shown on Figure 8. The two trenches were together about 110 feet long, and were positioned across the topographic slope break and base of slope where the fault had been mapped.

No indications of faults were observed in Trenches 10A and 10B (see Figures A-3 and A-4). The trenches were excavated to depths up to 12 to 15 feet below ground surface into older alluvium and colluvium, which appeared to be pre-Holocene age. Based on these trenches, the hillside topographic slope break does not appear to be related to a fault. Accordingly, the suspected fault was removed from the updated fault map of the site (Figure 8).

SECTION 5 GEOLOGIC HAZARDS

The following discussions, conclusions, and recommendations are based on review of local and regional geologic references including the fault hazard investigation performed for the site (URS 2001).

5.1 FAULT RUPTURE

The active Elsinore fault zone traverses the site and fault rupture is a significant hazard on site. The potential for surface faulting is considered to exist along all of the faults shown on Figure 8. The Main Fault and its branch faults exhibit evidence of Holocene activity and are considered to have the potential for future surface displacement.

The fault scarps within the property likely reflect combinations of horizontal (strike slip) and vertical fault movement. The relative sense of vertical movement along the Main Fault has been west side-down toward the San Luis Rey River valley (*i.e.,* the east side of the fault has moved up relative to the valley). If a major earthquake were to occur on this portion of the Elsinore fault, the land surface along the east side of the fault could experience sudden uplift, especially within the region of the “restraining bend.” If thrust faulting were to occur, ground deformations would be expected within the up-thrown fault block. Therefore, fault rupture could be accompanied by secondary faulting. Surface faulting is likely to be relatively constrained to locations of past fault ruptures; however, the branching fault pattern indicated within the property suggests that future fault rupture could also branch or step within the area between nearby traces.

Faults were not observed in the additional trenches (Trench 9, 10A, 10B and 11) located near the reservoir. The trenches were excavated into pre-Holocene alluvial fan deposits that did not appear to be displaced by a fault. Therefore the potential for fault rupture beneath the reservoir is low.

5.2 GROUND SHAKING

The project area could be subject to moderate or strong ground shaking in response to a local of more distant large magnitude earthquake. The Elsinore fault dominates the seismic ground shaking hazard for the site given its presence onsite, and its recognized potential to generate a large magnitude earthquake. Based on regional evaluations of probabilistic seismic shaking by the California Geological Survey the site area has an estimated peak ground acceleration of 0.61g associated with a 10 percent probability of exceedance in a 50-year period (CGS 2003).

5.3 SEISMICALLY INDUCED GROUND SETTLEMENT

Seismically induced settlements in loose alluvial materials have been observed during recent earthquakes (*e.g*., Northridge, California and Kobe, Japan earthquakes). These deformations resulted from contractive volumetric strains in unsaturated soil. Due to the presence of dry, sandy alluvial fan deposits at the site and the potential for strong ground shaking at the site, seismically induced settlements may occur at the site. Given the relative age (tens to hundreds of thousands of years old) and anticipated density of the bouldery alluvial fan deposits, any seismically induced settlements would be small. If settlements were to occur they would likely be limited to the upper 20 to 30 feet of alluvial soil at the site and are expected to occur relatively uniformly across the site.

5.4 LIQUEFACTION AND LATERAL SPREADING

Seismically induced soil liquefaction is a phenomenon in which loose to medium dense, saturate granular material undergo matrix rearrangement, develop high pore water pressure, and lose shear strengths due to cyclic ground vibration-induced by earthquakes. This soil liquefaction can include loss of bearing and lateral capacities for foundations, and surface deformations.

The potential for liquefaction is considered negligible at the site because the alluvial fan deposits underlying the site are very coarse-grained, relatively dense, and the occurrence of ground water is greater than about 300 feet below the site.

5.5 LANDSLIDES AND SLOPE INSTABILITY

No evidence of landsliding was noted during the geomorphic analysis and air photo interpretations for the previous fault investigation. Minor, surficial slope failures are possible during periods of significant ground shaking, but larger scale landsliding is not considered a significant hazard at the site given the geologic and geomorphic setting. If structures are located near steep slopes, specific slope stability evaluations should be performed during final design.

Rockfalls are a hazard in areas of steep, rocky terrain if large boulder outcrops are present. Large rocks can be dislodged during seismic or severe storm events. The steep terrain above the site area does not contain extensive areas of large boulder outcrops and does not appear likely to generate significant rockfalls in the project area.

5.5.1 Reservoir Embankment Stability

Based on an as-built survey drawing of the reservoir prepared by TerraData, 1998, the reservoir bottom is at approximate elevation 1,062 feet, MSL. The outlet pipe elevation is at approximate elevation 1,085 feet, MSL. The maximum depth of the reservoir is about 22 to 23 feet.

Figure 9 shows the current topography of the reservoir area as compared to the topography during a lower water level (probably during construction circa 1961). Judging from the 1961 topographic map, and the as-built drawing, grading to create the reservoir mostly consisted of excavating a bowl-shaped cut area within the older Quaternary alluvial fan deposits. The upper portion of a small drainage course at the base of the hillside apparently was filled during grading to create the reservoir, although some previous filling may have taken place prior to construction of the reservoir.

A fill slope bounds the reservoir on its west and south sides, as shown approximately on Figure 9. Figure 10 shows generalized cross sections of this area based on the current site topographic map, estimated subsurface conditions based on site reconnaissance. The embankment fill slope is up to about 25 feet high (measured from the approximate water level to the fill slope toe) and has downstream slope inclinations between about 2.5:1 and 3:1 (Figure 10). The fill slope toe is along the top of stockpiled boulders in some areas.

No indications of groundwater seepage were observed along the slopes below the reservoir. Groundwater was not encountered in Trench 9, which was excavated just below the fill slope toe.

In order to evaluate seismic slope stability, screening analyses were performed based on the procedures outlined by ASCE (2002). Representative geologic cross sections through the reservoir were prepared based on the as-built survey drawing of the reservoir. Preliminary evaluations of slope stability were performed using Slope W version 5.11 (Geo-Slope International Ltd., 2002) using assigned values for the soil properties and evaluating both static and pseudo static cases. In this type of analysis, a horizontal destabilizing seismic coefficient (k) is applied to the cross sections. Seismic coefficients assumed a reduction of the estimated peak ground acceleration of 0.61g generally according to Caltrans procedures. The k factors assumed for the analysis ranged between 0.2 and 0.3. With this application of seismic shaking, the factors of safety (ratio of total stabilizing forces divided by the external driving forces acting on a potential slide mass) were above 1.0. A minimum factor of safety of about 1.1 is typically desired for short term stability during an earthquake.

Based on the preliminary slope stability analyses, the relatively flat fill slopes bordering the reservoir (with inclinations of 2.5:1 and 3:1, horizontal to vertical) are considered grossly stable for both static and pseudo static cases.

5.6 COLLAPSIBLE AND EXPANSIVE SOILS

Soils that collapse during wetting may be encountered in alluvial deposits when wetting causes chemical or physical bonds between soil particles to weaken. This allows the structure of the soil to collapse and the ground surface to subside. In order to collapse, soil must have weak cementation or cohesive structure that can be modified by the addition of water. Based on the dense, coarse-grained character of the onsite materials the soils at the site are not susceptible to collapse.

Expansive soils are those that contain significant amounts of clays that expand when wetted and can cause damage to foundations if moisture collects beneath structures. Expansive soils are not present in the subsurface at the site and are not likely in the alluvial fan deposits. Expansive soils are not a significant hazard consideration at the site.

5.7 OTHER HAZARDS

Depending on the duration of strong seismic shaking, overtopping of the existing reservoir on the property could occur during a large earthquake as a result of a seiche (*i.e.,* the oscillation of a contained body of water). Some water contained within the reservoir could slosh over the top of the slopes bounding the reservoir.

The water level in the existing reservoir is maintained at a level about 5 feet below the top of the embankment fill slope by the existing outlet at elevation 1,085 feet, MSL. The existing access road is about 10 feet wide and is at approximate elevation 1,090 feet, MSL. In the event of a seiche, the 5-feet of "freeboard" between the reservoir water surface and top of the road would tend to contain reservoir water and the potential for significant overtopping is low. If spillage were to occur, some of the runoff would be intercepted by the small natural drainage courses down slope of the reservoir. Runoff would likely be dissipated by the stockpiled boulders below the reservoir (Figure 9).

SECTION 6 IMPACTS AND MITIGATIONS

The assessment of impact to the project resulting from possible geologic hazard is based on available published geologic information including information developed by the State of California, and the site specific information developed for the project (URS 2001), and this update investigation. An adverse impact is considered significant if a geologic hazard could cause damage to facilities or present a significant threat to public safety.

6.1 FAULT RUPTURE

There are active faults strands present within the project site as identified in previous sections and shown on Figure 7. Ground rupture along such faults is a potentially adverse impact. Adverse impacts resulting from surface rupture can be mitigated by locating habitable structures away from the fault traces. Such setbacks from active faults are described in the fault hazard investigation (URS 2001) and summarized here. These recommended setbacks are consistent with the Alquist-Priolo Earthquake Fault Zoning Act. Fifty-foot setbacks are recommended from mapped fault traces located during trenching for the fault hazard investigation (URS 2001). Setbacks of 100 feet are recommended in areas where the fault is located approximately based on air photo interpretations, geomorphology, and published geologic maps.

In general, setback lines are established for the areas of proposed development west of the Main Fault, as shown on Figure 7. Areas upslope and to the east of the Main Fault have not been proposed for construction of habitable structures. Additional studies would be required to evaluate the siting of habitable structures east of the Main Fault.

Based on the previous fault investigation (URS 2001), and the additional trenches performed for this update study, the reservoir does not appear to overlie an active fault. The branch faults previously mapped on site do not extend below the reservoir. No other faults appear to be present extending near or below the reservoir.

Lacking indications of active faults extending below the existing reservoir, fault rupture is not considered a significant geologic hazard to the reservoir. No significant impacts to the reservoir are anticipated as a result of fault rupture.

6.2 GROUND SHAKING

Significant levels of ground shaking may be experienced at the site given the seismic setting of the area. Potential adverse impacts resulting from seismic ground shaking will be mitigated by implementing appropriate design measures. Use of 2007 Uniform Building Code (UBC) design measures will address structural design requirements for residential buildings and other structures that will safeguard against major structural damage and loss of life (not to limit damage or maintain function). Use of the appropriate design and construction methods per 2007 UBC will allow for ground shaking hazards to be mitigated to a less than significant level.

6.3 SEISMICALLY INDUCED GROUND SETTLEMENT

No significant impacts are anticipated at the site as a result of seismically induced ground settlement based on anticipated subsurface conditions. This conclusion should be verified during design level geotechnical investigations for the proposed residential structures. Mitigations, if warranted, could include overexcavation and recompaction of a fill mat below proposed structures and/or slabs and foundations enhanced structurally to accommodate anticipated settlements. Appropriate mitigations are available, if necessary, to reduce any settlement impacts to a less than significant level..

6.4 LIQUEFACTION AND LATERAL SPREADING

No significant impacts are anticipated at the site as a result of seismically induced liquefaction or lateral spreading. The site is not susceptible to liquefaction due to the coarse-grained materials and deep occurrence of ground water. No mitigations are recommended.

6.5 LANDSLIDES AND SLOPE INSTABILITY

No landslide hazards have been identified for the proposed project. Final design investigations should verify slope stability for structures near slopes and provide setback recommendations, if necessary. Seismic shaking could induce minor slope failures in some of the areas near natural drainage courses with steep alluvial slopes. Potential impacts resulting from seismically included slope instabilities can be mitigated to a less than significant level by establishing appropriate setbacks from slope edges.

The existing reservoir embankment appears grossly stable based on preliminary evaluations of static and pseudostatic stability which include seismic coefficients. Following a seismic event, the water level within the reservoir could be lowered using the existing gravity pipelines to check the reservoir condition. Additional temporary drainage lines could be installed. No significant impacts are anticipated as a result of fill slope instability.

6.6 COLLAPSIBLE AND EXPANSIVE SOILS

No collapsible or expansive soils have been identified for the proposed project and therefore no impacts are anticipated and no mitigations required.

6.7 OTHER HAZARDS

The project drainage system should be checked for its ability to handle short term, concentrated flows if significant reservoir overtopping were to occur during an earthquake. The existing reservoir freeboard would likely significantly reduce the potential for seismic-induced overtopping. Runoff would likely be dissipated and distributed by the natural drainage courses and rough bouldery terrain upslope of the proposed residential area. Moreover, storm drains at natural drainage crossings will be designed to accommodate 100-year storm frequency flows.

The proposed access road below the reservoir (see Figure 2) will include a brow ditch and other drainage features that will also help route overland flow away from the proposed residential area. In addition, one or more berms or other diversion structures should be considered to route flow away from the proposed structures. No significant impacts are anticipated as a result of seismic-induced reservoir overtopping.

SECTION 7 REFERENCES

ASCE. 2002. “Recommended Procedures for Implementation of DMG Special Publication 117: Guidelines for Analyzing and Mitigation Landslide Hazards in California” published by the Southern California Earthquake Center.

California Department of Conservation Division of Mines and Geology. 1990. Microfiche copies of Fault Evaluation Reports for the Peninsular Ranges. Open file report 90-13.

California Division of Mines and Geology. 1980. Special Study Zones, Pala, California, 7.5-minute Quadrangle.

California Division of Mines and Geology. 1994. “Fault Rupture Hazard Zones in California, Special Publication 42.”

California Geological Survey. 2000. “Earthquake Catalog for the Period From 1769 to 2000.”

California Geological Survey (CGS). 2003. The Revised 2002 California Probabilistic Seismic Hazard Maps.” URL: http//www.consrv.ca.gov/CGS/rghm/psha/index.htm

Kennedy, M.P., 2000, Geologic Map of the Pala 7.5’ Quadrangle, San Diego County, California: A Digital Database, published by California Division of Mines and Geology in cooperation with USGS

Magistrale, H. and T.K. Rockwell. 1996. “The Central and Southern Elsinore Fault Zone, Southern California” Bulletin of Seismological Society of America. Vol. 86. No. 6, pp. 1793-1803.

Slemmons, D.B., and C.M DePolo. 1986. “Evaluation of Active Faulting and Associated Hazards in Active Tectonics.” National Academy Press, Washington, D.C.

State of California, Special Studies Zones, Pala Quadrangle. Effective January 1, 1980.

Toppozada, D. and others. 2000. “Epicenters of Areas of Damaged by M≥5 California Earthquakes, 1800-1999.” California Division Mines and Geology, Map Sheet 49.

Vaughan, P.R., K.M. Thorup, and J.K. Rockwell. 1999. “Paleoseismology of the Elsinore Fault at Agua Tibia Mountain, Southern California.” Bulletin of the Seismological Society of America, Vol. 89, No. 6 pp. 1447-1457.

Vaughan, P.R. 1987. “Alluvial Stratigraphy and Neotectonics along the Elsinore Fault Zone at Agua Tibia Mountain, California.” Master’s Thesis, University of Colorado, Boulder. 182 p.

Vaughan, P., and T. Rockwell. 1986. “Alluvial Stratigraphy and Neotectonics of the Elsinore Fault Zone at Agua Tibia Mountain, Southern California in Neotectonics and Faulting in Southern California.” Prepared for the 82nd annual meetings of the Cordilleran Section of the Geological Society of America, Los Angeles, California, 1986.

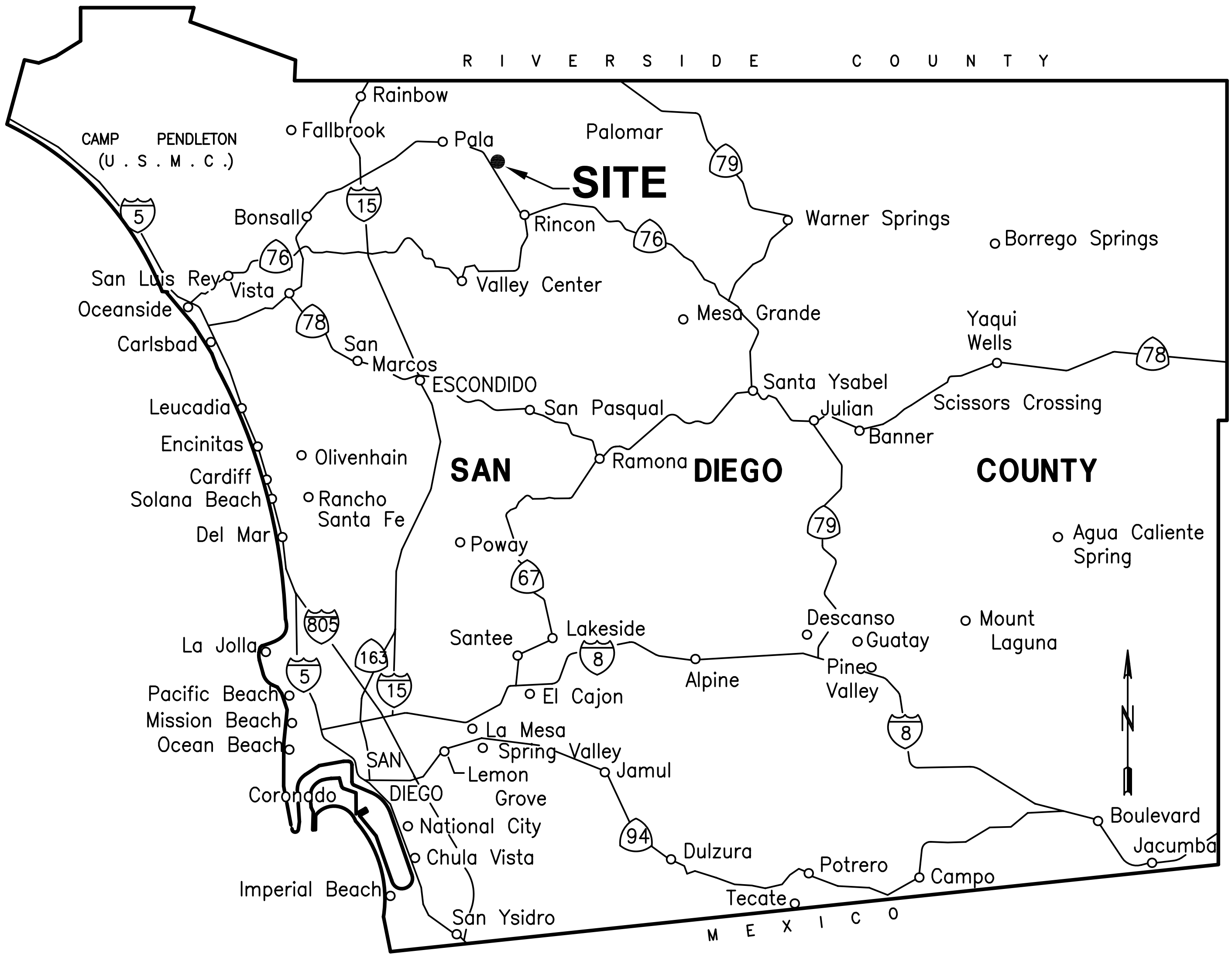
URS Corporation, 2001, "Fault Hazard Investigation, Schoepe Tentative Map, Pauma Valley, San Diego County, California," dated December 4, 2001.

Table 1
SUMMARY OF SOIL AGE ESTIMATES
(from Vaughn and Rockwell, 1986)

Geomorphic Surface	Classification	Profile	Hue	Chroma	Color Index[1]	Fine-Med/ Total Clay	Estimated Age Ranges In Years (Best Estimate in Parentheses)[2]
Q1	Xerorthents	A/C				N.D.	<20
Q2	Xeropsamments or Xerorthents	A/Cox				N.D.	70-2200
Q3	Haploxerolls or Xerumbrepts	A/Bw or A/Cox	10YR	3	4	0.76	2500-6000
Q4	Haploxerolls, Xerumbrepts or Haploxeralfs	A/Btj or A/Bt	10YR	4	5	0.80	8-15Ka[2]
Q5	Haploxeralfs	A/Bt	7.5-10YR	3-4	6	0.90	15-70Ka (15-40Ka)
Q6	Palexeralfs	A/Bt	5YR	5	7	0.94	50-250Ka (70-180Ka)
Q7	Palexeralfs	A/Bt	2.5-5YR	6	9.5	0.92	130-6000Ka (250-600Ka)

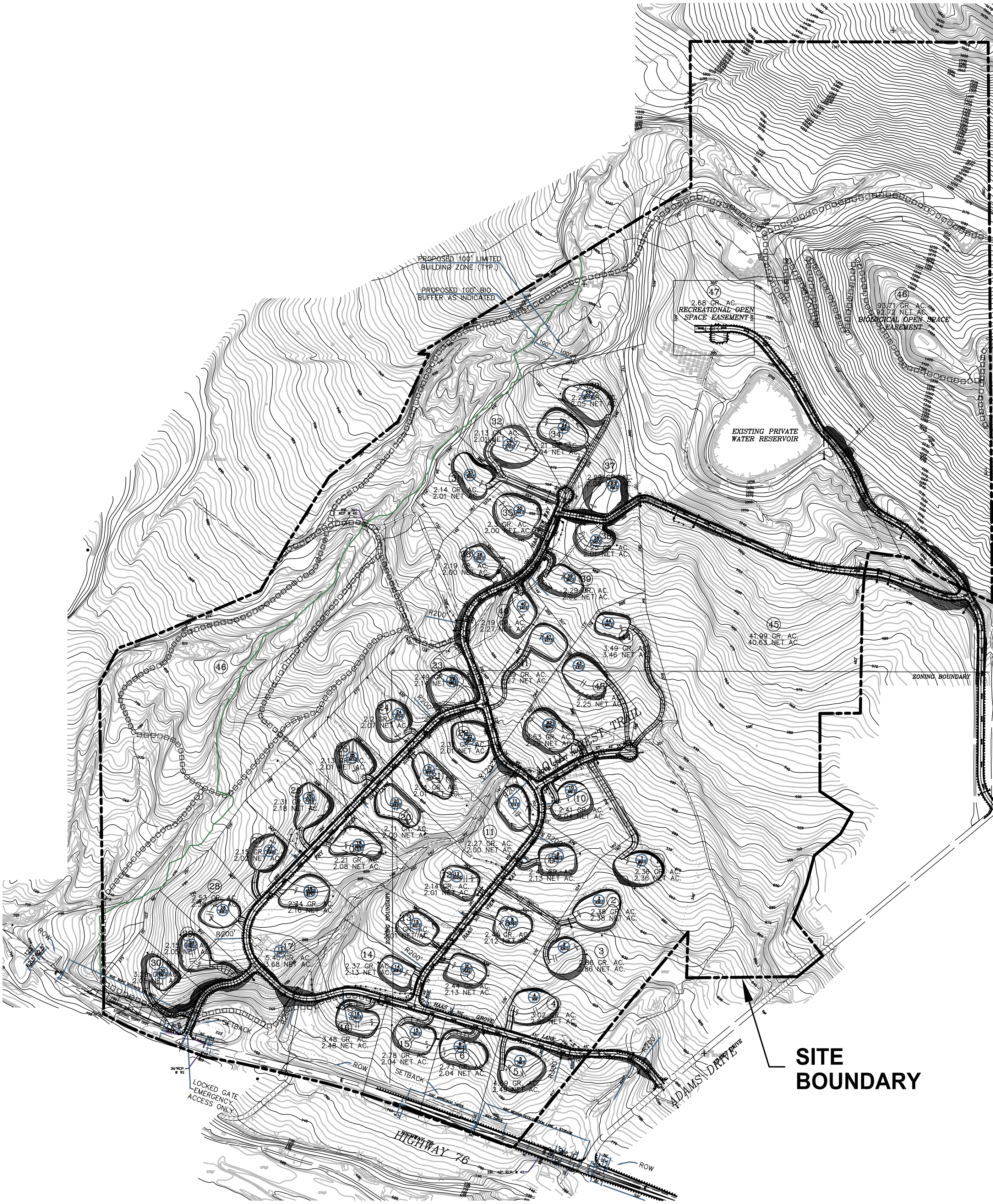
Notes:

1. Color index after Rockwell and others, 1985.
2. Ka = 1000 years before present



URS	VICINITY MAP GEOLOGIC HAZARD STUDY SHADOW RUN RANCH		
NOT TO SCALE	CHECKED BY:	DATE: 04-14-09	FIG. NO: 1
	PM: DLS	PROJ. NO: 27665024.00003	

X:\27665024\SHADOW RUN VICMAP.dwg Apr 16, 2009 - 1:15pm



SITE LAYOUT
GEOLOGIC HAZARD STUDY
SHADOW RUN RANCH

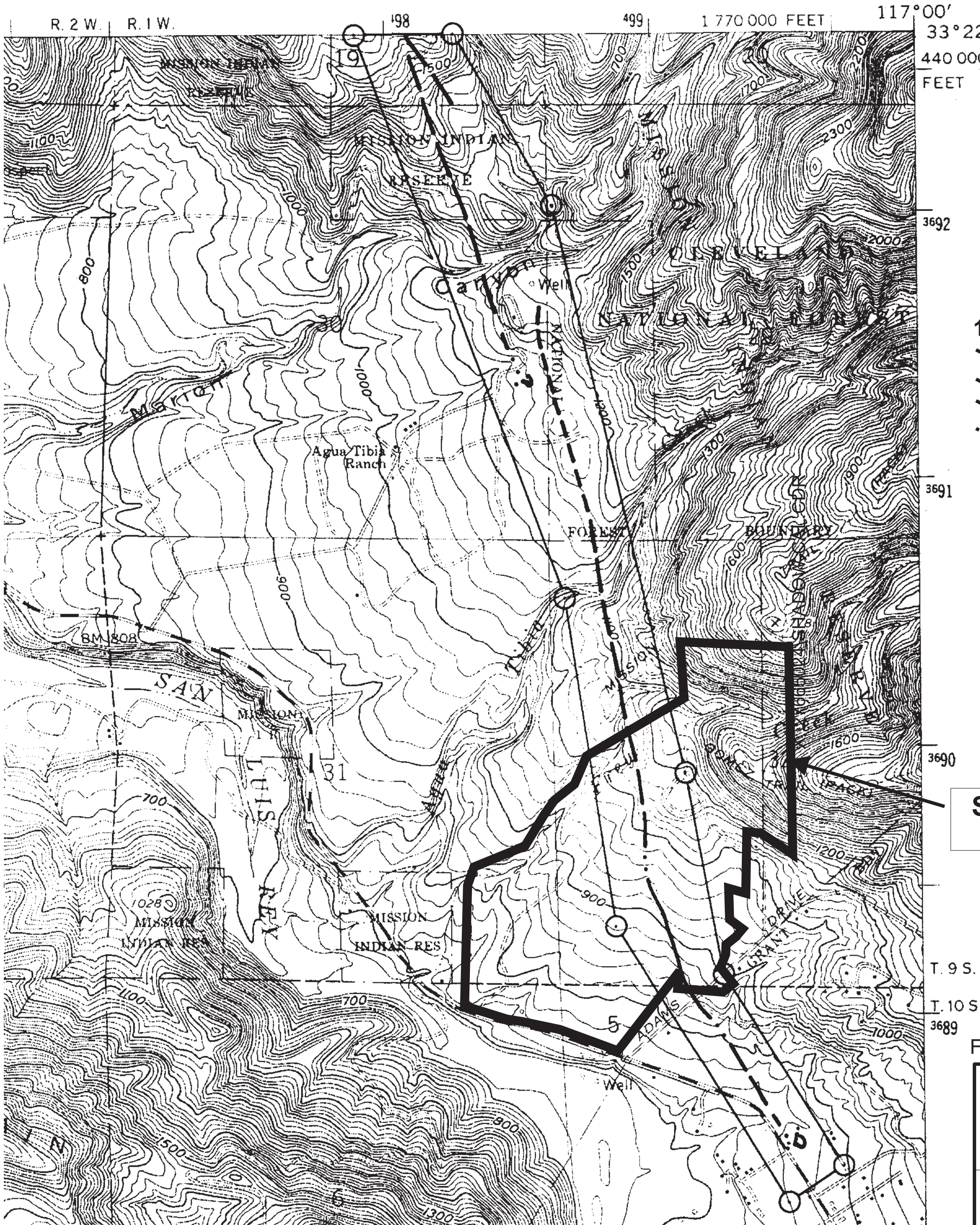
URS

300 0 300 600 Feet

SCALE: 1"= 600'

CHECKED BY:	DATE: 04-14-09	FIG. NO:
PM: DLS	PROJ. NO: 27665024.00003	2

X:\27665024\03-09\Shadow Run Site Plan.dwg Apr 16, 2009 - 1:13pm



SITE BOUNDARY
(Approximate)

MAP EXPLANATION

Potentially Active Faults

1906 C

Faults considered to have been active during Quaternary time; solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed; query (?) Indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event to C for displacement caused by creep or possible creep.

Special Studies Zone Boundaries

These are delineated as straight-line segments that connect encircled turning points so as to define special studies zone segments.

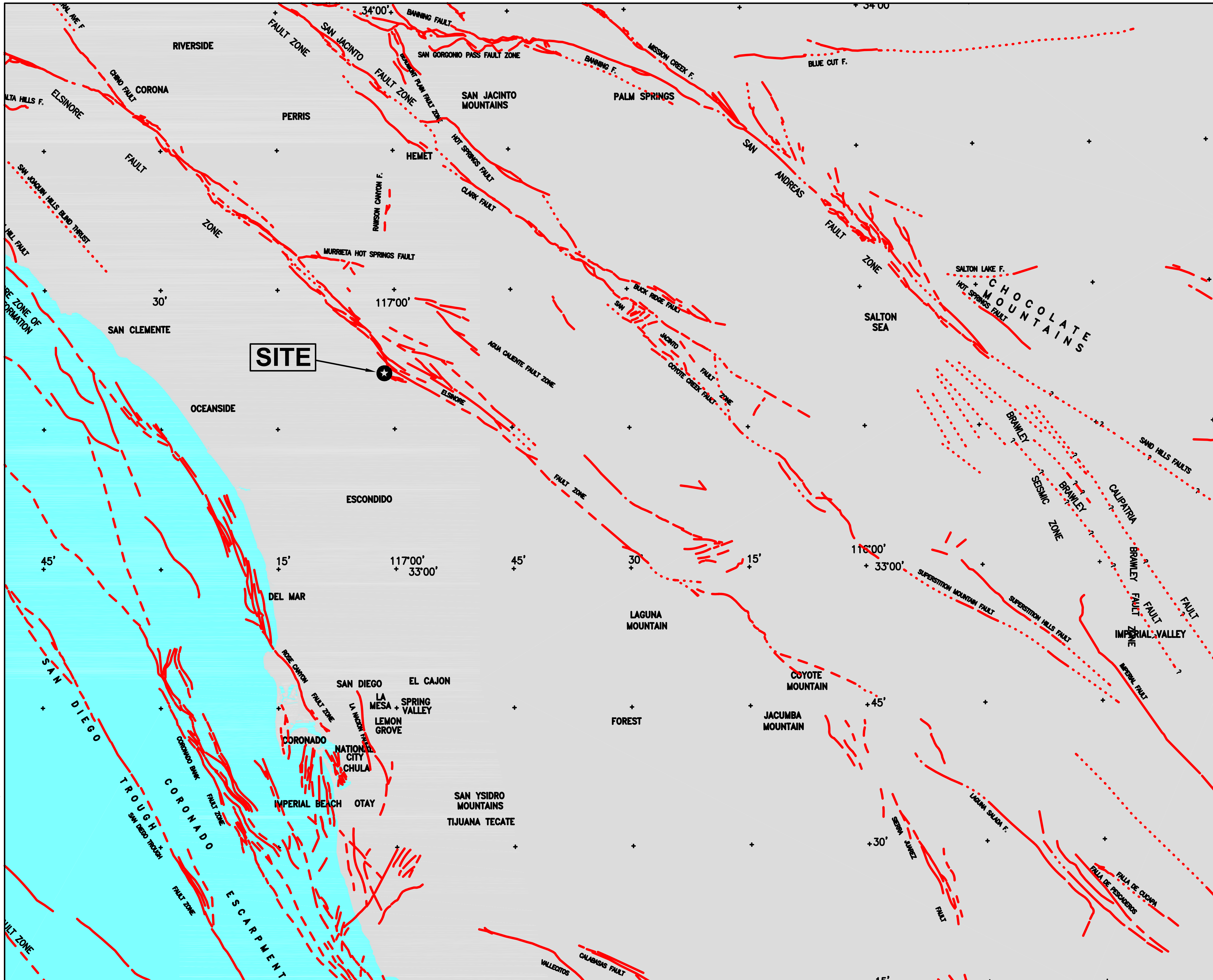
0 2000 4000

Graphic Scale (Feet)

FROM DMG (1980)

STATE OF CALIFORNIA SPECIAL STUDIES ZONE - PALA QUADRANGLE GEOLOGIC HAZARD STUDY SHADOW RUN RANCH			
URS	CHECKED BY:	DATE: 04-14-09	FIG. NO: 3
	PM: DLS	PROJ. NO: 27665024.00003	

X:\27665024\SHADOW RUN REGIONAL FAULTS.dwg Apr 16, 2009 – 1:30pm



LEGEND

REPORTED EARTHQUAKE MAGNITUDES.

4.0 TO 4.9
5.0 TO 5.9
6.0 TO 6.9
7.0 AND GREATER

SOUTH OF LATITUDE 35°N, EPICENTER AND MAGNITUDE DATA ARE FROM THE CALIFORNIA GEOLOGICAL SURVEY (2000) EARTHQUAKE CATALOG FOR THE PERIOD FROM 1769 TO 2000. ONLY EARTHQUAKES OF MAGNITUDE 4.0 AND LARGER ARE SHOWN. AFTERSHOCKS ARE NOT INCLUDED.

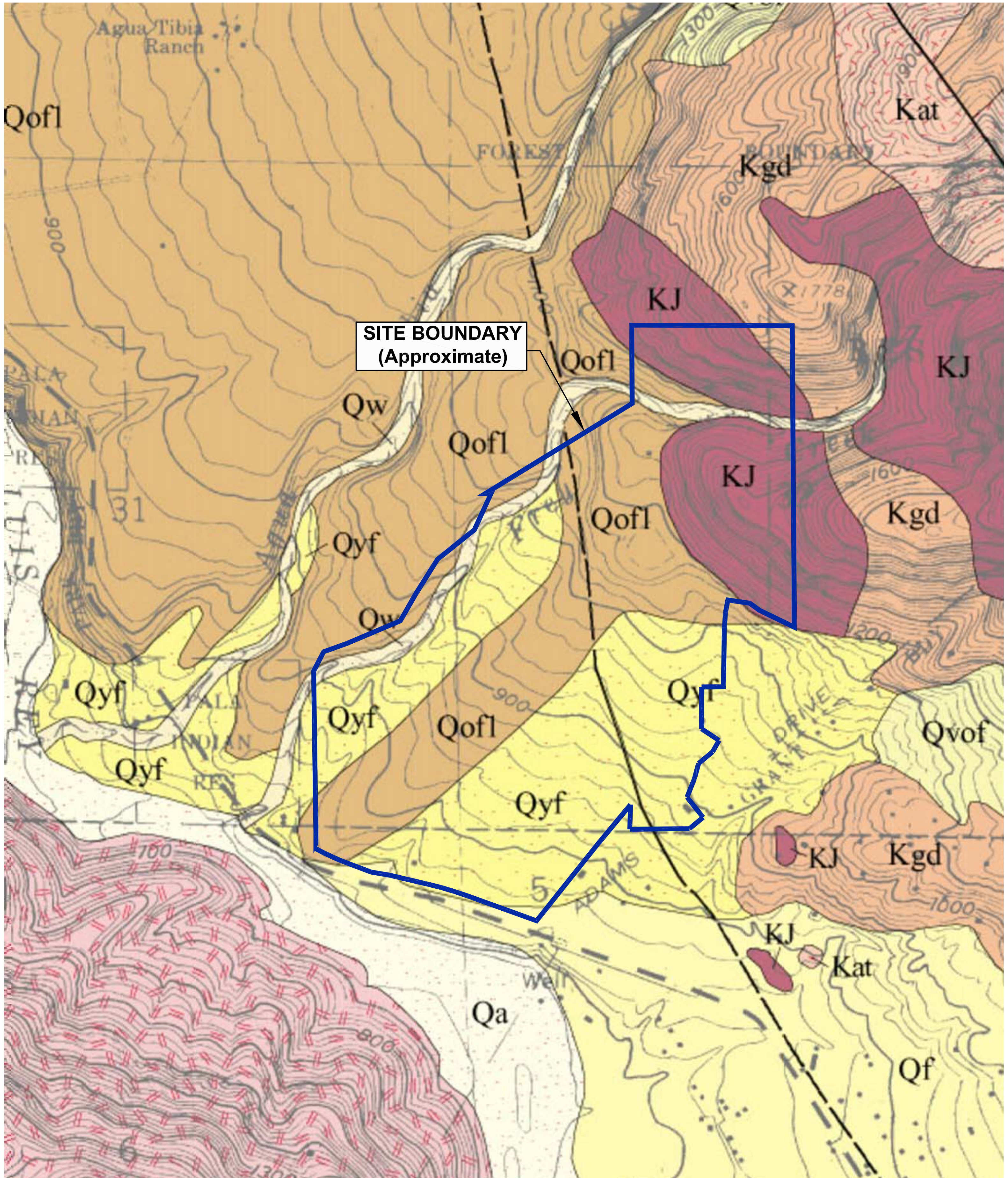
? ? ?

APPROXIMATE LOCATION OF HOLOCENE AND PLEISTOCENE FAULTS, DOTTED WHERE CONCEALED, QUERIED WHERE CONJECTURAL. FAULT LOCATIONS BASED ON: ZIONY AND JONES, 1989; CDMG GEOLOGIC MAP SERIES OF CALIFORNIA, 1977–1986 (1:250,000 SCALE); CDMG GEOLOGIC MAP SERIES, CALIFORNIA CONTINENTAL MARGIN, 1987 (1:250,000 SCALE); HAUKSSON, 1990; SHAW AND SHEARER, 1999; WRIGHT, 1991; GRANT ET AL. 1999.

URS

REGIONAL FAULT AND EPICENTER MAP

Proj. No.: 27665024.00003	Date: 04/14/09
Project: GEOLOGIC HAZARD STUDY SHADOW RUN RANCH	Figure: 4



DESCRIPTION OF MAP UNITS

MODERN SURFICIAL DEPOSITS - Sediment that has been recently transported and deposited in channels and washes, on surfaces of alluvial fans and alluvial plains, and on hillslopes and in artificial fills. Soil-profile development is non-existant. Includes:

Qf — Active alluvial fan deposits (late Holocene) - Unconsolidated to locally poorly consolidated sand, gravel, cobble and boulder deposits in active alluvial fans.

Qa — Active alluvial flood plain deposits (late Holocene) - Unconsolidated to locally poorly consolidated sand and gravel deposits in active alluvial flood plains.

YOUNG SURFICIAL DEPOSITS - Sedimentary units that are slightly consolidated to cemented and slightly to moderately dissected. Alluvial fan deposits typically have high coarse:fine clast ratios. Younger surficial units have upper surfaces that are capped by slight to moderately developed soil profiles. Includes:

Qyf — Young alluvial fan deposits (Holocene and late Pleistocene) - Mostly poorly consolidated and very poorly sorted sand, gravel, cobble and boulder deposits in young alluvial fans.

OLD SURFICIAL DEPOSITS - Sedimentary units that are moderately consolidated and slightly to moderately well dissected. Older surficial deposits have upper surfaces that are capped by moderately to well-developed soils. Includes:

Qofl — Older fan deposits (Pleistocene, younger than 500,000 years but older than Qof2 deposits) - Mostly poorly consolidated fan, debris flow and talus deposits. Clasts are distinctly deeply weathered and the matrix distinctly reddish brown in color.

BEDROCK UNITS

Kat — Gabbro of the Agua Tibia Mountains (Cretaceous) - Hornblende gabbro; medium to coarse grained, massive to foliate. This gabbro often contains minor biotite and quartz (quartz bearing gabbro).

Kgd — Granodiorite undivided (Cretaceous) - Mostly hornblende-biotite granodiorite; coarse to medium grained.

KJ — Metavolcanic and metasedimentary rocks undivided (Cretaceous and Jurassic) - Low grade (greenschist facies) rocks that are in part coeval with and in part older than the Cretaceous plutonic rocks they lie in contact with.

MAP SYMBOLS

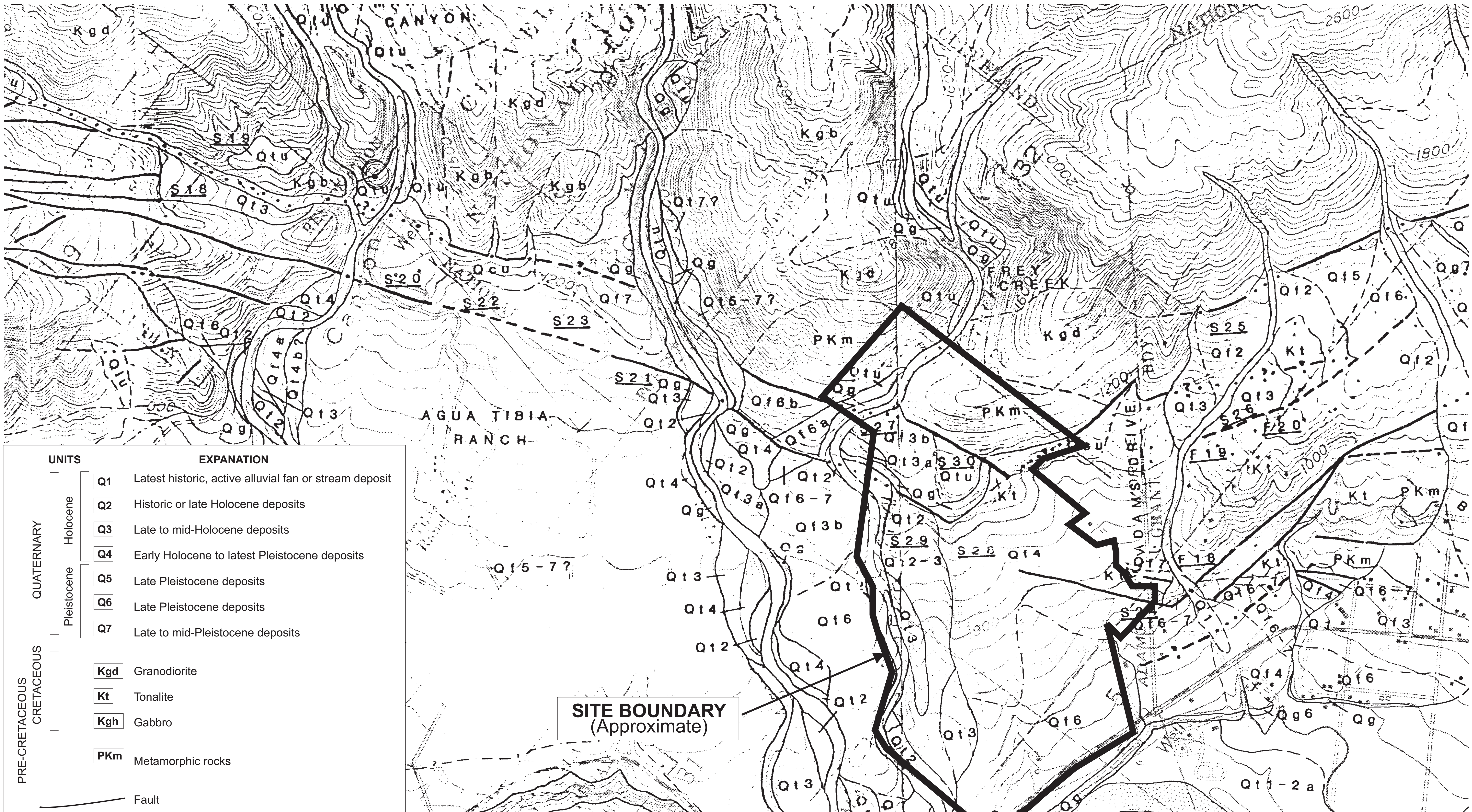
Contact between map units.

Fault - dashed where inferred, dotted where concealed.

MAP SOURCE: Kennedy, 2000

N	GEOLOGIC MAP GEOLOGIC HAZARD STUDY SHADOW RUN RANCH		
URS	500 0 500 1000 Feet SCALE: 1"= 1000'	CHECKED BY:	DATE: 04-14-09	FIG. NO: 5
		PM: DLS	PROJ. NO: 27665024.00003	

X:\27665024\03-09\Shadow Run Geologic Map.dwg Apr 16, 2009 – 1:22pm



UNITS			EXPANATION
QUATERNARY	Holocene	Q1	Latest historic, active alluvial fan or stream deposit
		Q2	Historic or late Holocene deposits
		Q3	Late to mid-Holocene deposits
		Q4	Early Holocene to latest Pleistocene deposits
	Pleistocene	Q5	Late Pleistocene deposits
		Q6	Late Pleistocene deposits
		Q7	Late to mid-Pleistocene deposits
PRE-CRETACEOUS	CRETACEOUS	Kgd	Granodiorite
		Kt	Tonalite
		Kgh	Gabbro
		PKm	Metamorphic rocks

Fault

Possible fault

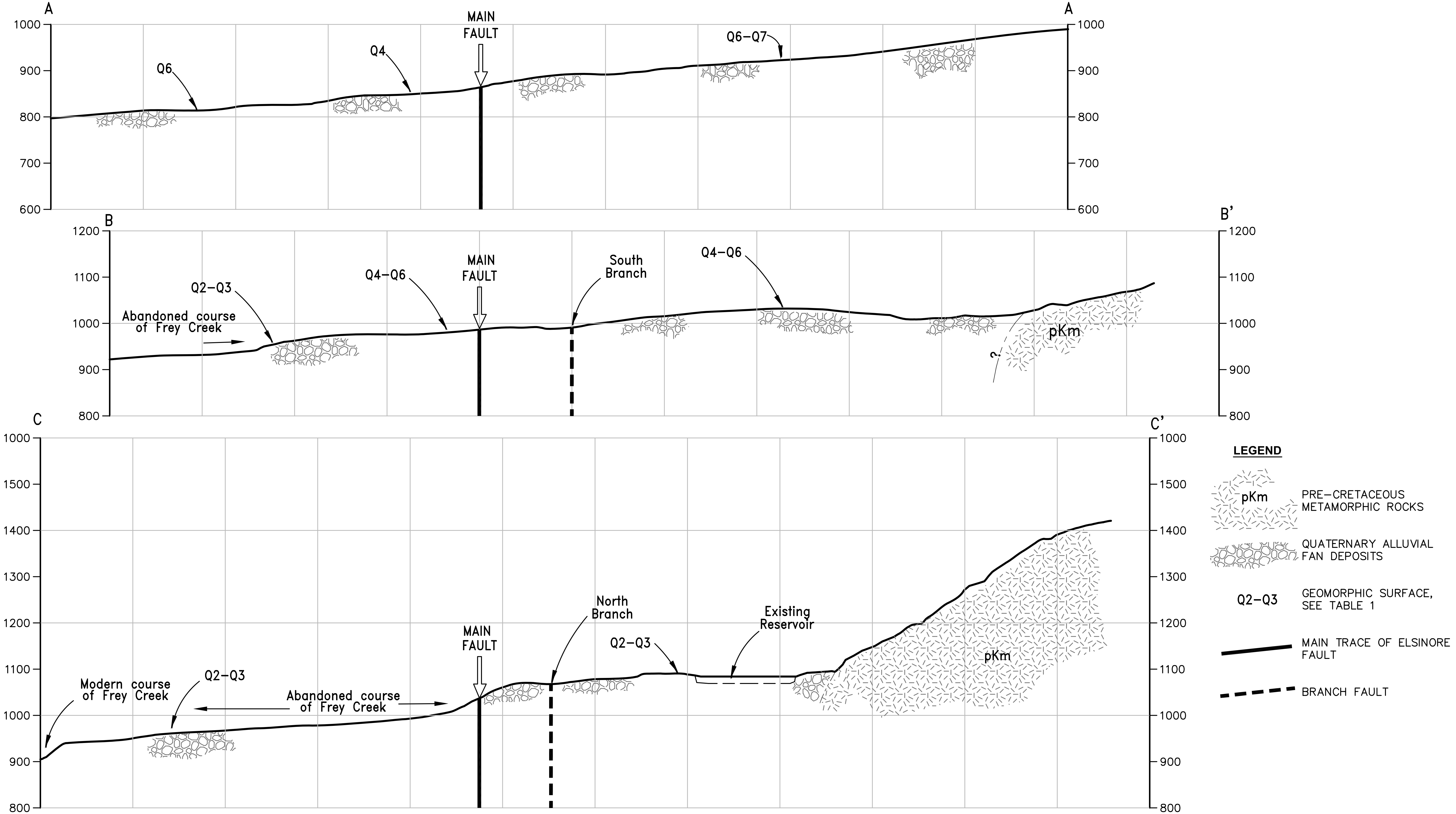
Fault, scarp expressed in topography, tectonic origin uncertain

Fault, concealed by alluvial deposits; queried where existence in uncertain

QUATERNARY GEOLOGIC MAP
GEOLOGIC HAZARD STUDY
SHADOW RUN RANCH

URS	CHECKED BY:	DATE: 04-14-09	FIG. NO:
	PM: DLS	PROJ. NO: 27665024.00003	6

X:\00161062\SCHOEPE-GEOL.CDR



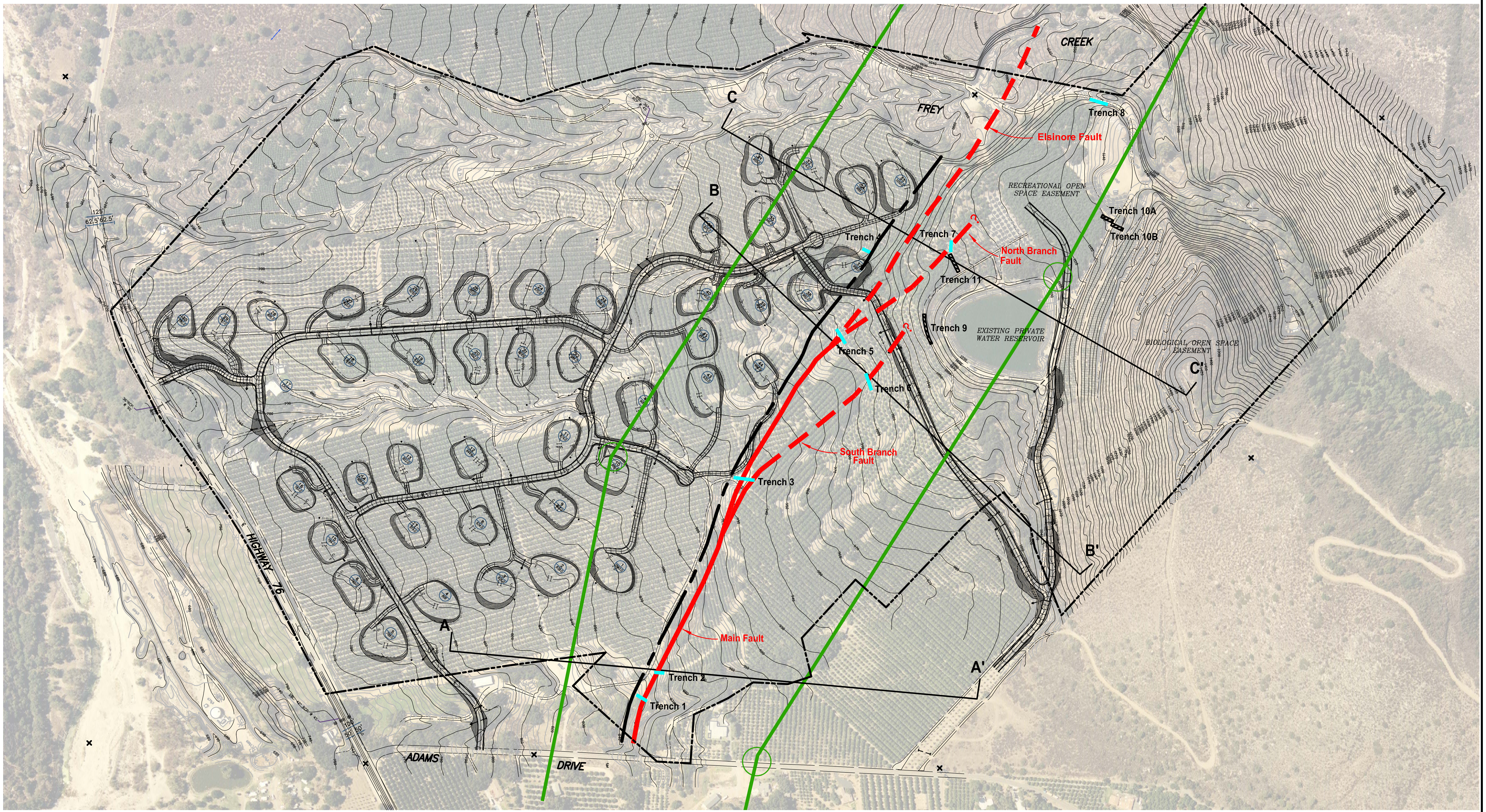
CROSS SECTION A-A' THROUGH C-C'
GEOLOGIC HAZARD STUDY
SHADOW RUN RANCH

URS

100 0 100 200 Feet
SCALE: 1"= 200'

CHECKED BY:	DATE: 04–14–09	FIG. NO: 7
PM: DLS	PROJ. NO: 27665024.00003	

X:\27665024\03-09\Shadow Run Old Sections.dwg Apr 16, 2009 – 1:24pm



LEGEND:

FAULT, DASHED WHERE APPROXIMATE	PREVIOUS EXPLORATORY TRENCH (URS, 2001)
FAULT SETBACK BOUNDARY (WEST OF MAIN FAULT)	EARTHQUAKE FAULT ZONE (APPROXIMATE)
SUPPLEMENTAL TRENCH LOCATION (URS, 2009)	GEOLOGIC CROSS SECTION

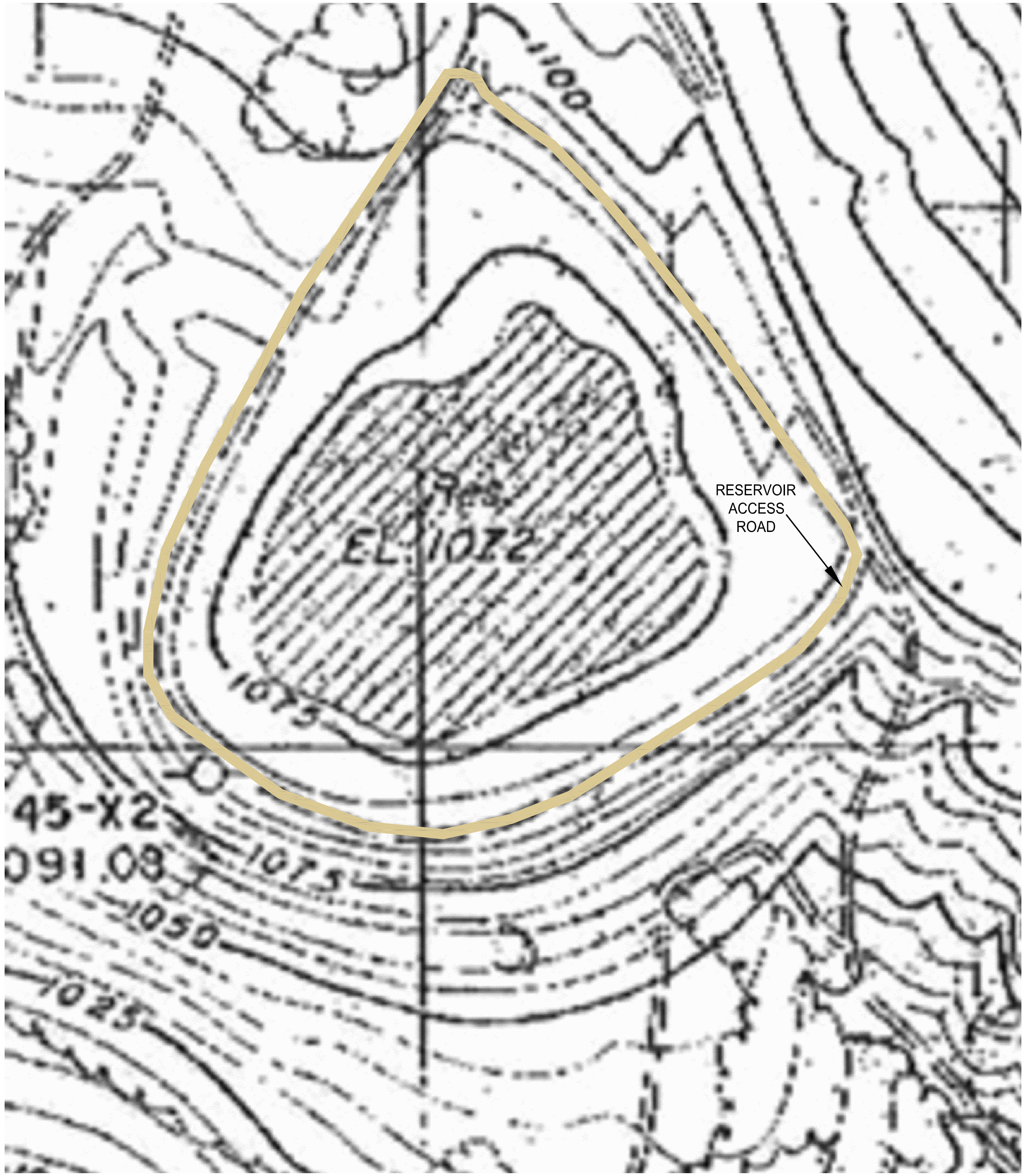
FAULT MAP
GEOLOGIC HAZARD STUDY
SHADOW RUN RANCH

URS

200 0 200 400 Feet
SCALE: 1"= 400'

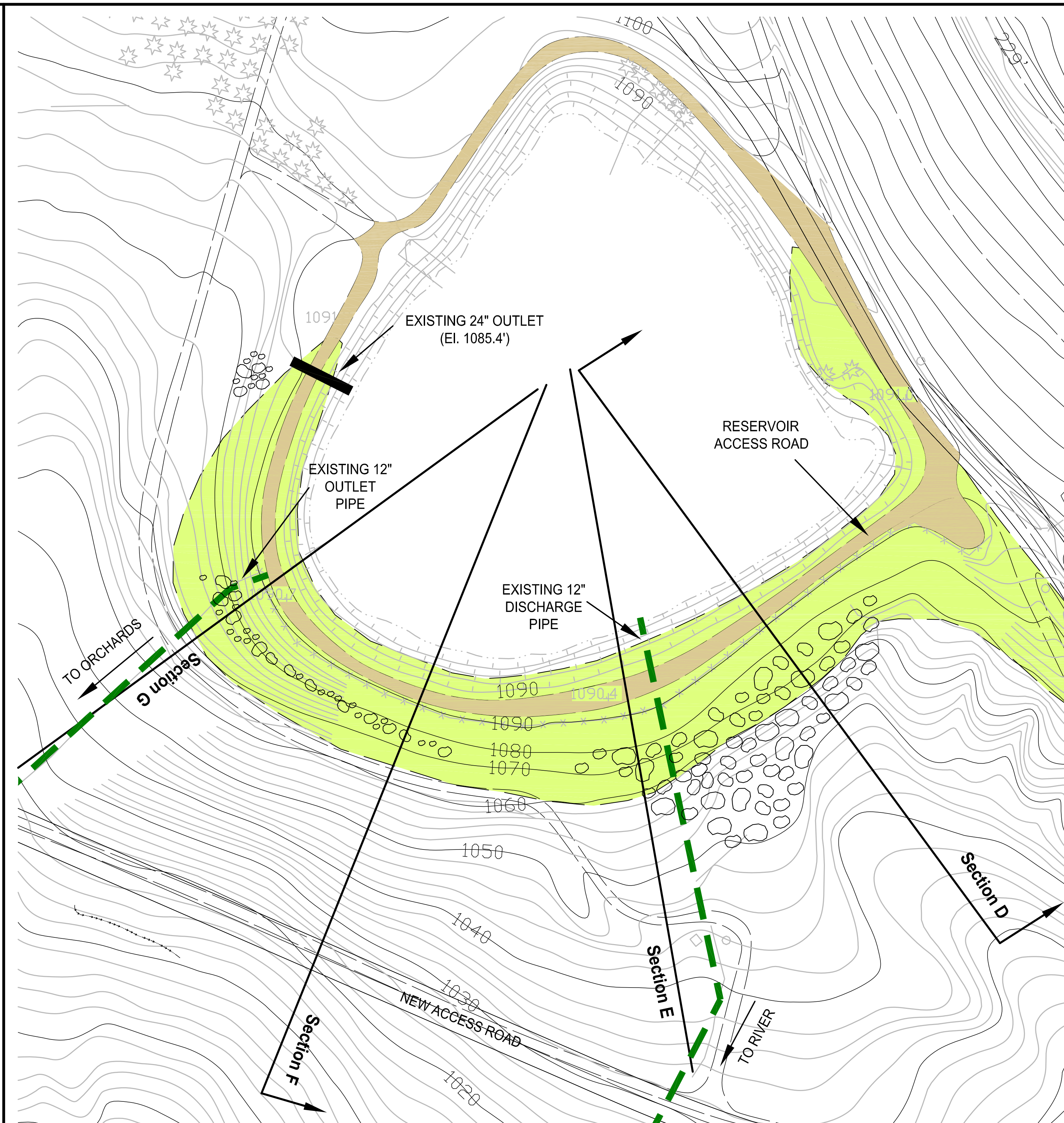
CHECKED BY:	DATE: 04-14-09	FIG NO: 8
PM: DLS	PROJ. NO: 27665024.00003	

X:\27665024\03-09\Shadow Run Current Fault Map.dwg Apr 16, 2009 - 1:19pm



1961 TOPOGRAPHIC MAP

SOURCE: San Diego County, Sheet 430–1767



CURRENT TOPOGRAPHY

LEGEND

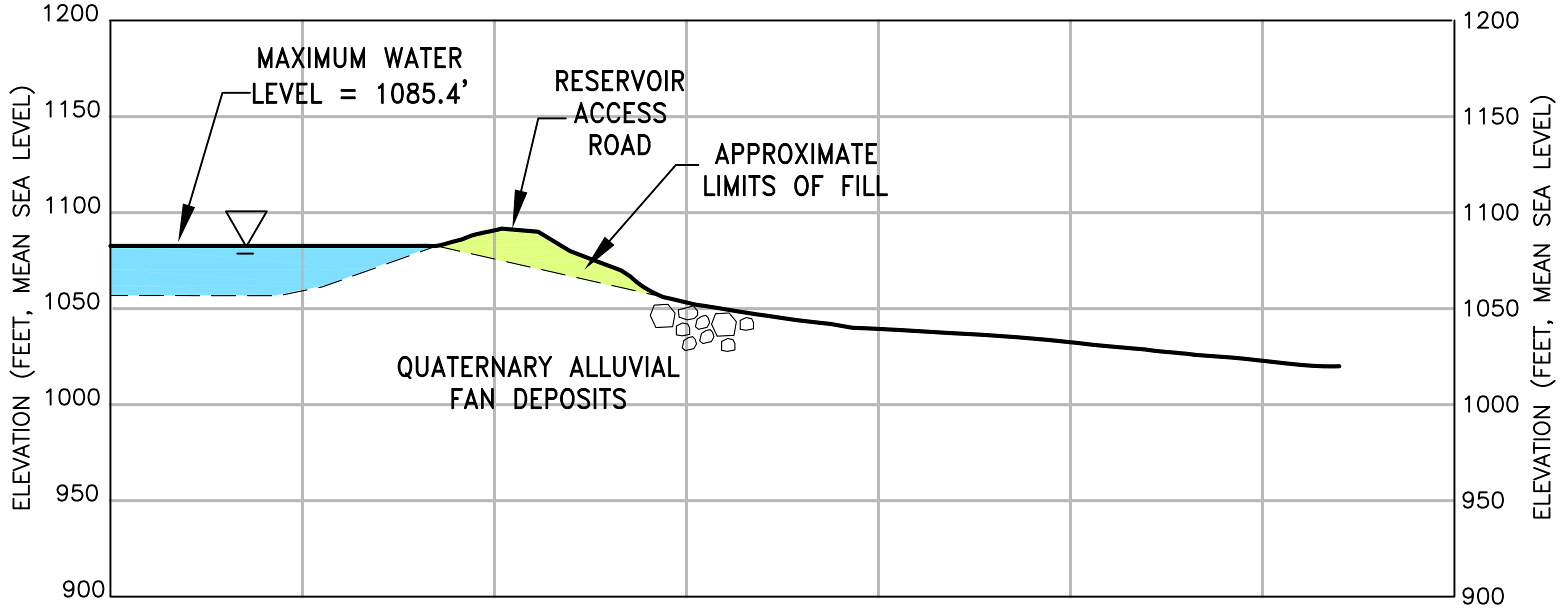
FILL (APPROXIMATE LIMITS)

STOCKPILED BOULDERS (APPROXIMATE LIMITS) NOT TO SCALE

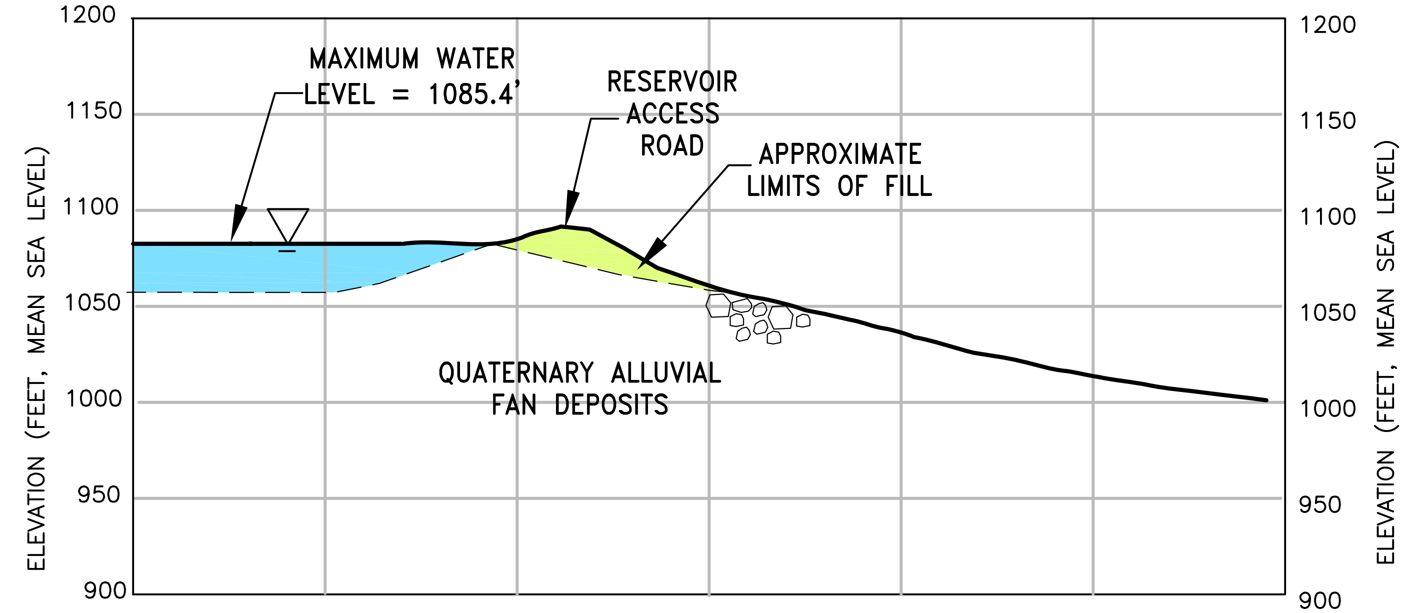
N / URS	TOPOGRAPHIC MAPS EXISTING RESERVOIR SHADOW RUN RANCH		
SCALE: 1"= 100' (50 0 50 100 Feet)	CHECKED BY:	DATE: 04–14–09	FIG. NO: 9
	PM: DLS	PROJ. NO: 27665024.00003	

X:\27665024\03-09\Shadow Run Existing Reservoir.dwg Apr 16, 2009 – 1:21pm

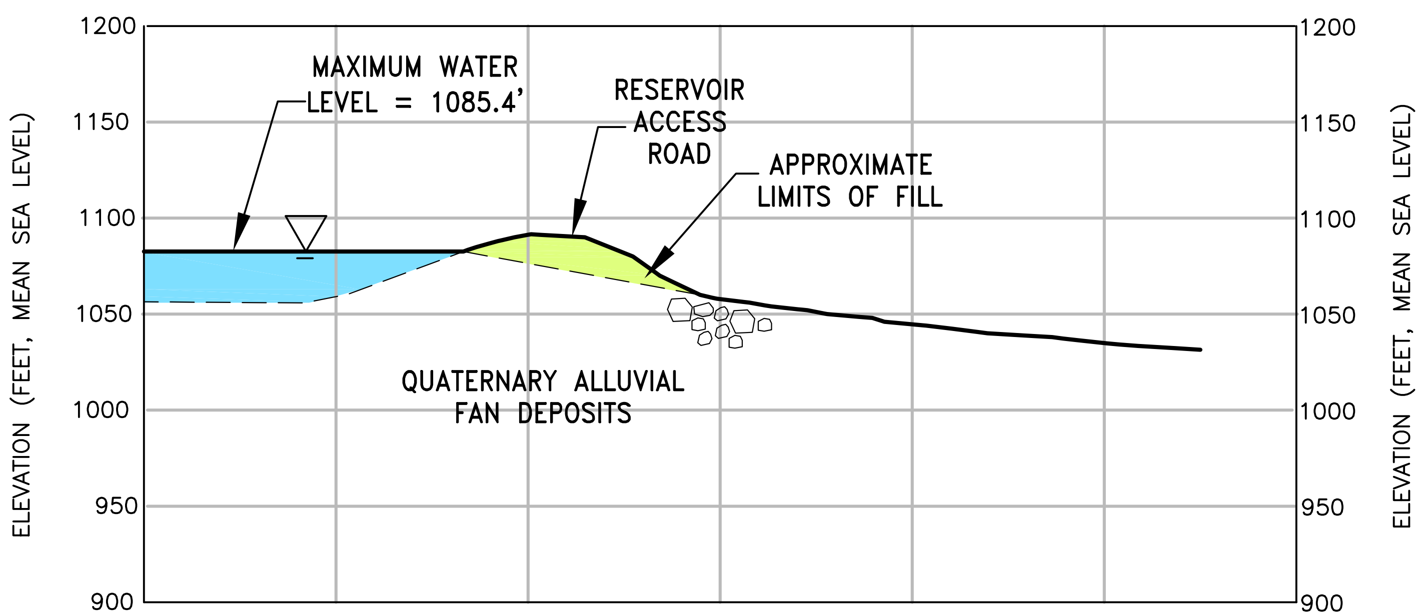
SECTION D



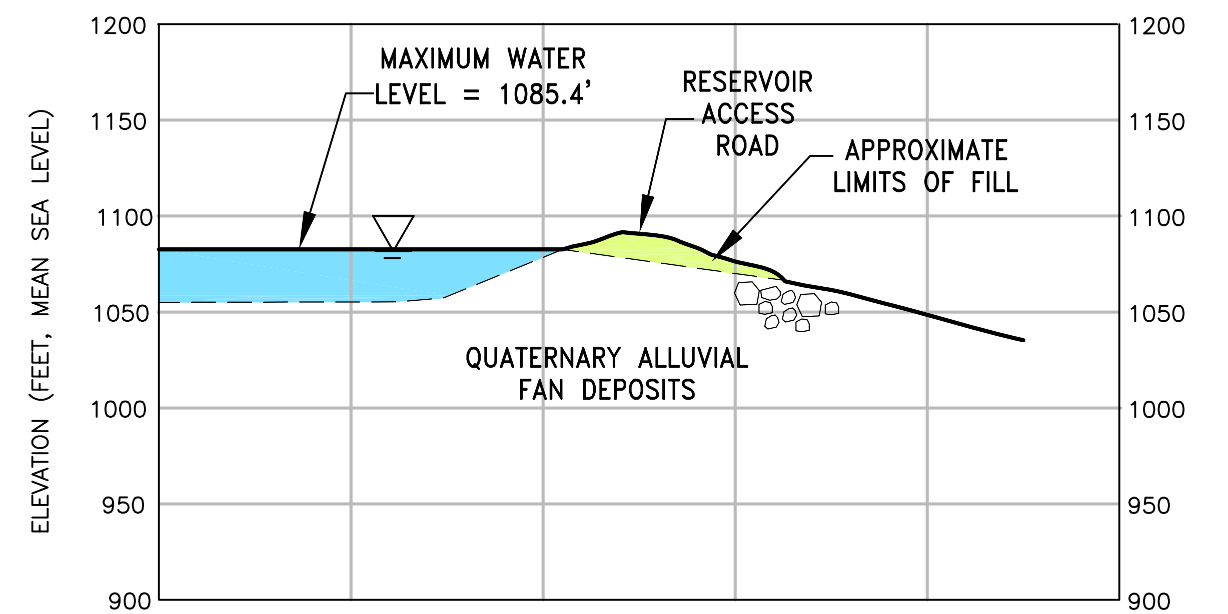
SECTION E



SECTION F



SECTION G



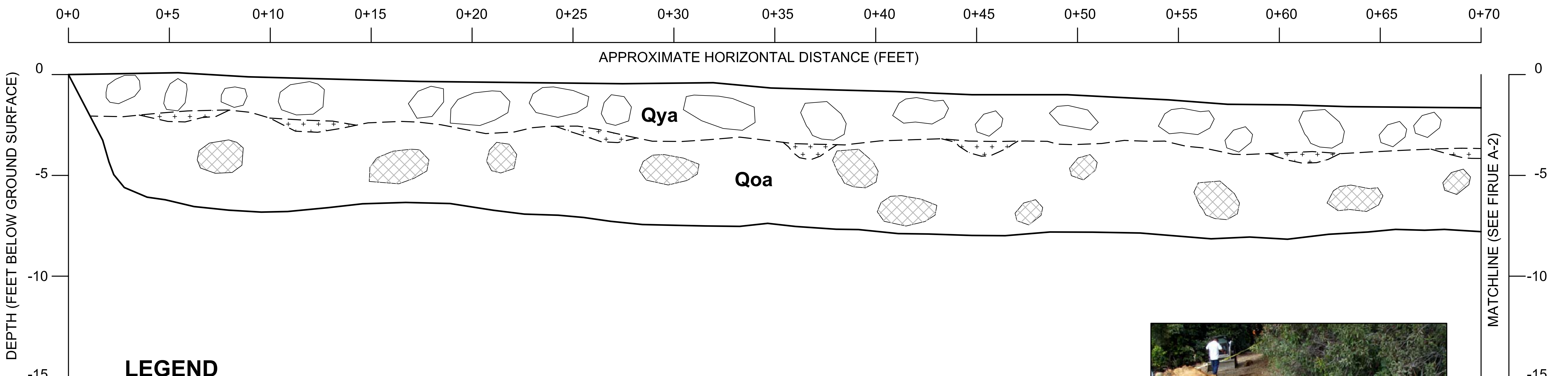
GENERALIZED CROSS SECTIONS D, E, F AND G
EXISTING RESERVOIR
SHADOW RUN RANCH

URS

50 0 50 100 Feet
SCALE: 1"= 100'

CHECKED BY: | DATE: 04-14-09 | FIG. NO: 10
PM: DLS | PROJ. NO: 27665024.00003

X:\27665024\03-09\Shadow Run New Sections.dwg Apr 16, 2009 - 1:23pm



LEGEND

- HIGHLY WEATHERED TO DECOMPOSED BOULDER
- PALEOSOL
- MODERATELY WEATHERED TO FRESH BOULDER
- APPROXIMATE UNIT BOUNDARY

YOUNGER ALLUVIUM (Qya)
DARK BROWN, LOAMY SILTY SAND (SM), WITH GRAVELS AND LARGE BOULDERS UP TO 5' LONG. BOULDERS ARE MOSTLY UNWEATHERED TO FRESH AND REPRESENT ~60% OF THE UNIT. FRESH, UNWEATHERED BOULDERS EXPOSED ON THE SURFACE LOCALLY.

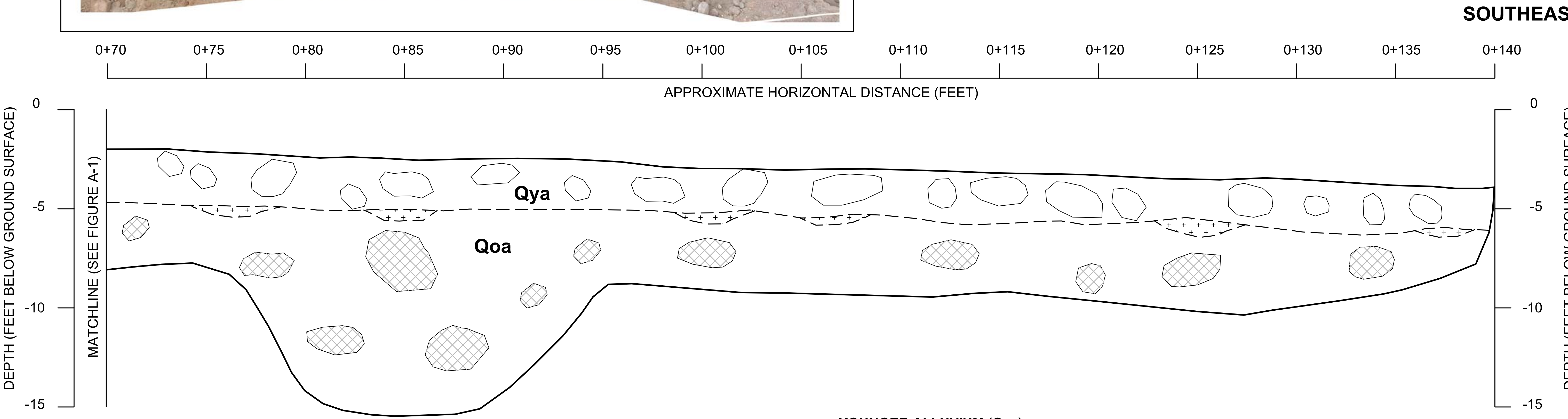
OLDER ALLUVIUM (Qoa)
YELLOWISH BROWN, SILTY FINE TO COARSE SAND (SM) WITH SOME FINE GRAVELS AND BOULDERS UP TO 2.5' LONG. ARGILLIC HORIZON LOCALLY PRESENT ON SURFACE OF UNIT. BOULDERS ARE HIGHLY WEATHERED TO DECOMPOSED AND REPRESENT ~30% OF THE UNIT.


VIEW WEST ALONG TRENCH 9

LOG OF TRENCH 9
SHADOW RUN RANCH

URS	2.5 0 2.5 5 Feet SCALE: 1"= 5'	CHECKED BY:	DATE: 04-14-09	FIG. NO: A-1
		PM: DLS	PROJ. NO: 27665024.00003	

X:\27665024\03-09\Shadow Run Trench Logs.dwg Apr 16, 2009 - 1:26pm



LEGEND

HIGHLY WEATHERED TO DECOMPOSED BOULDER

PALEOSOL

MODERATELY WEATHERED TO FRESH BOULDER

APPROXIMATE UNIT BOUNDARY

YOUNGER ALLUVIUM (Qya)
DARK BROWN, LOAMY SILTY SAND (SM), WITH GRAVELS AND LARGE BOULDERS UP TO 5' LONG. BOULDERS ARE MOSTLY UNWEATHERED TO FRESH AND REPRESENT ~60% OF THE UNIT. FRESH, UNWEATHERED BOULDERS EXPOSED ON THE SURFACE LOCALLY.

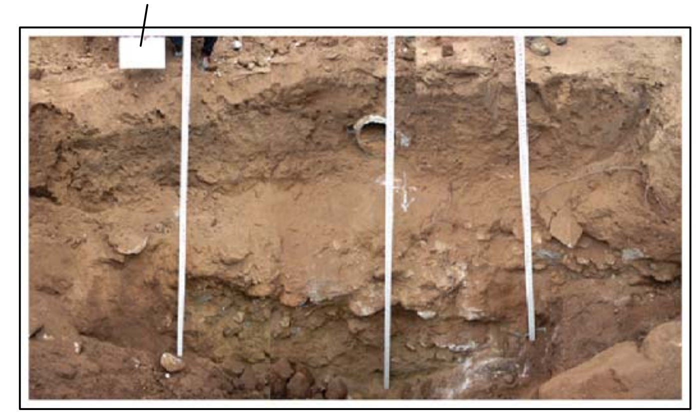
OLDER ALLUVIUM (Qoa)
YELLOWISH BROWN, SILTY FINE TO COARSE SAND (SM) WITH SOME FINE GRAVELS AND BOULDERS UP TO 2.5' LONG. ARGILLIC HORIZON LOCALLY PRESENT ON SURFACE OF UNIT. BOULDERS ARE HIGHLY WEATHERED TO DECOMPOSED AND REPRESENT ~30% OF THE UNIT.

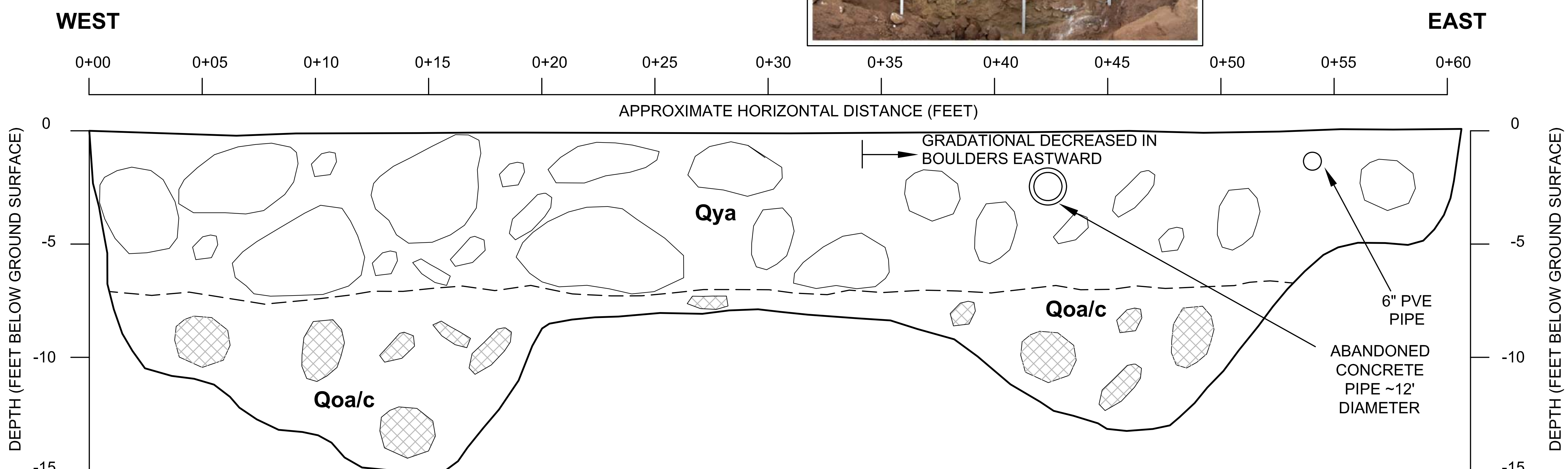
LOG OF TRENCH 9 (CONT'D)
SHADOW RUN RANCH

URS	2.5 0 2.5 5 Feet SCALE: 1"= 5'	CHECKED BY:	DATE: 04–14–09	FIG. NO: A-2
		PM: DLS	PROJ. NO: 27665024.00003	

X:\27665024\03-09\Shadow Run Trench Logs.dwg Apr 16, 2009 – 1:27pm

STA. 35





LEGEND

HIGHLY WEATHERED TO DECOMPOSED BOULDER

MODERATELY WEATHERED TO FRESH BOULDER

APPROXIMATE UNIT BOUNDARY

YOUNGER ALLUVIUM (Qya)
DARK BROWN, LOAMY SILTY SAND (SM), WITH GRAVELS AND LARGE BOULDERS UP TO 6' LONG. BOULDERS DECREASE IN SIZE AND QUANTITY EASTWARD AS THE UNIT GETS CLOSER TO THE SLOPE TO THE EAST. FRESH UNWEATHERED BOULDERS EXPOSED IN THE SURFACE LOCALLY.

OLDER ALLUVIUM/COLLUVIUM (Qoa/c)
YELLOWISH BROWN TO REDDISH BROWN, SILTY SAND (SM) WITH SOME BOULDERS (HIGHLY WEATHERED TO DECOMPOSED). GRADES EASTWARD (UPSLOPE) TO A SILTY SAND WITH CLAY (SM)

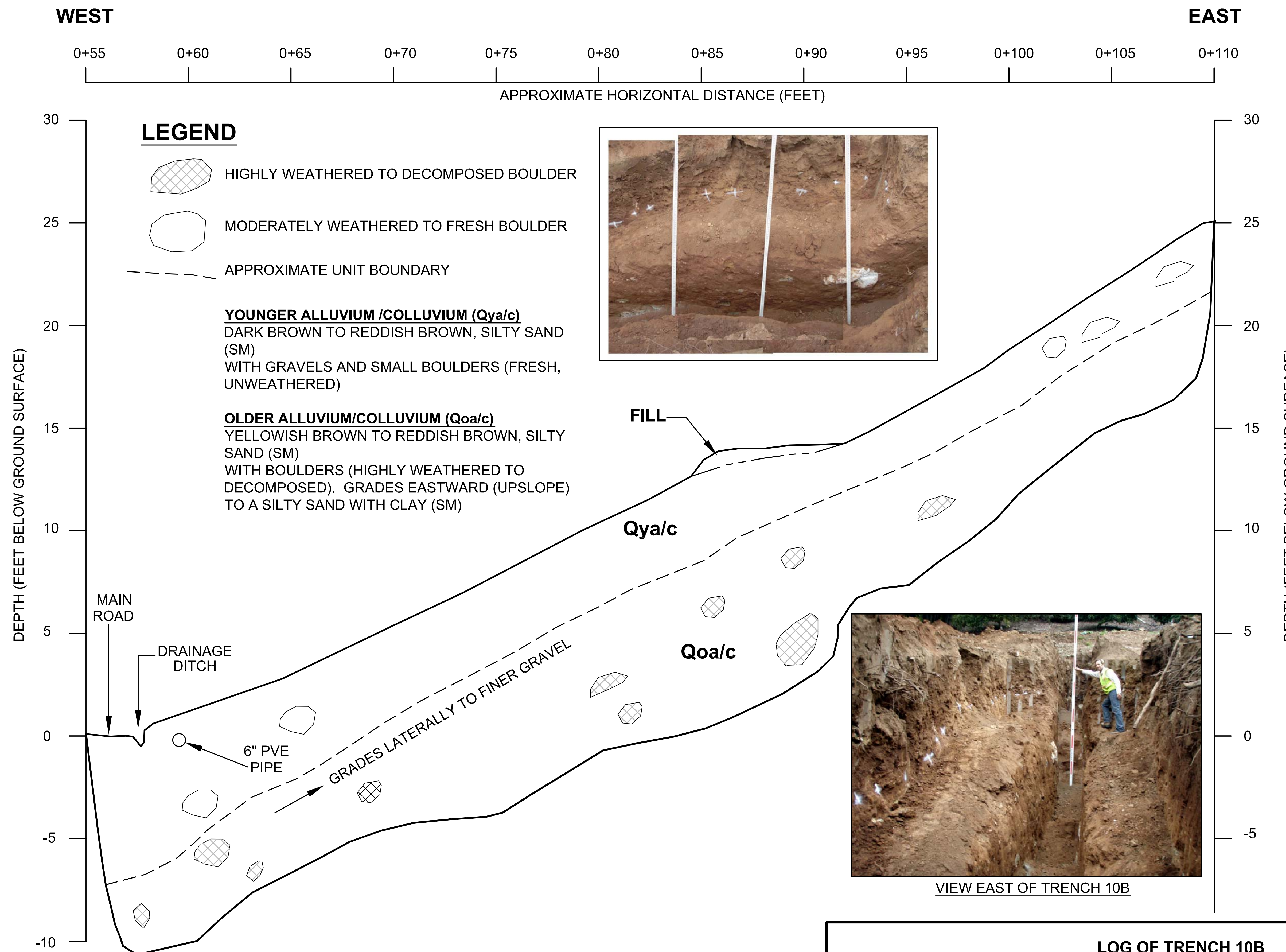
VIEW WEST OF TRENCH 10A

VIEW WEST OF TRENCH 10B

LOG OF TRENCH 10A
SHADOW RUN RANCH

URS	2.5 0 2.5 5 Feet SCALE: 1"= 5'	CHECKED BY:	DATE: 04–14–09	FIG. NO: A-3
		PM: DLS	PROJ. NO: 27665024.00003	

X:\27665024\03–09\Shadow Run Trench Logs.dwg Apr 16, 2009 – 1:28pm

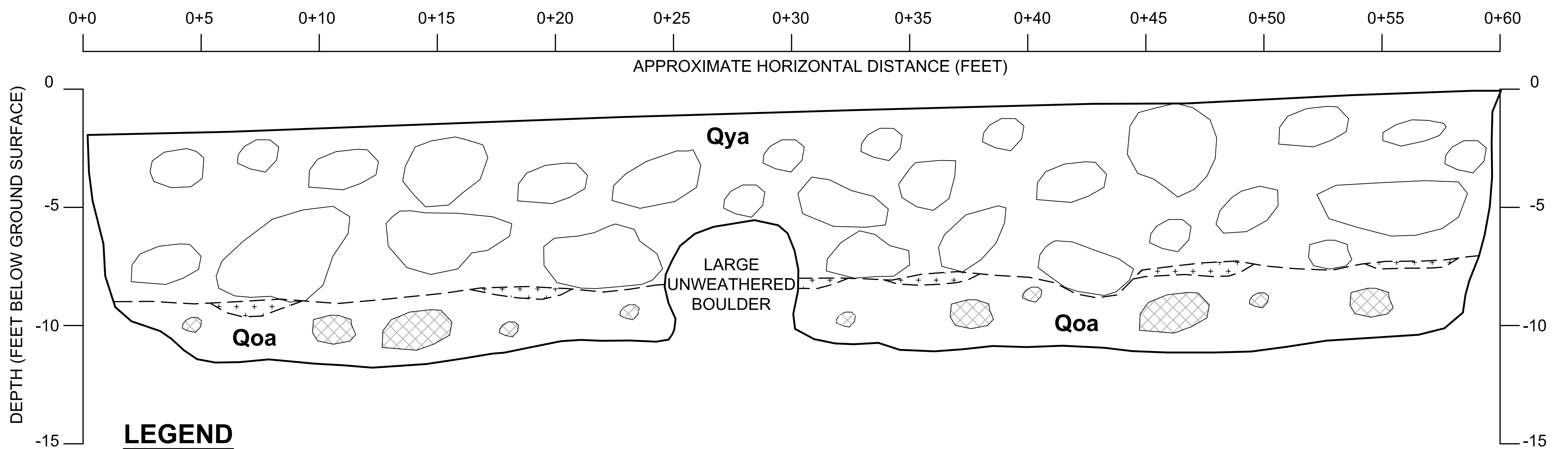


VIEW EAST OF TRENCH 10B

LOG OF TRENCH 10B
SHADOW RUN RANCH

URS	2.5 0 2.5 5 Feet SCALE: 1"= 5'	CHECKED BY:	DATE: 04-14-09	FIG. NO: A-4
		PM: DLS	PROJ. NO: 27665024.00003	

X:\27665024\03-09\Shadow Run Trench Logs.dwg Apr 16, 2009 - 1:28pm



LEGEND

HIGHLY WEATHERED TO DECOMPOSED BOULDER

PALEOSOL

MODERATELY WEATHERED TO FRESH BOULDER

APPROXIMATE UNIT BOUNDARY

YOUNGER ALLUVIUM (Qya)
DARK BROWN, LOAMY SILTY SAND (SM), WITH GRAVELS AND LARGE BOULDERS UP TO 5' LONG. BOULDERS ARE MOSTLY UNWEATHERED TO FRESH AND REPRESENT ~60% OF THE UNIT. FRESH, UNWEATHERED BOULDERS EXPOSED ON THE SURFACE LOCALLY.

OLDER ALLUVIUM (Qoa)
YELLOWISH BROWN, SILTY FINE TO COARSE SAND (SM) WITH SOME FINE GRAVELS AND BOULDERS UP TO 2.5' LONG. ARGILLIC HORIZON LOCALLY PRESENT ON SURFACE OF UNIT. BOULDERS ARE HIGHLY WEATHERED TO DECOMPOSED AND REPRESENT ~30% OF THE UNIT.

LOG OF TRENCH 11
SHADOW RUN RANCH

URS

2.5 0 2.5 5 Feet
SCALE: 1"= 5'

CHECKED BY:	DATE: 04–14–09	FIG. NO:
PM: DLS	PROJ. NO: 27665024.00003	A-5

X:\27665024\03–09\Shadow Run Trench Logs.dwg Apr 16, 2009 – 1:29pm